HEATING & VENTILATING

For Engineers and Contractors Controlling the Design, Specification, Installation and Maintenance of Heating, Ventilating and Air Conditioning

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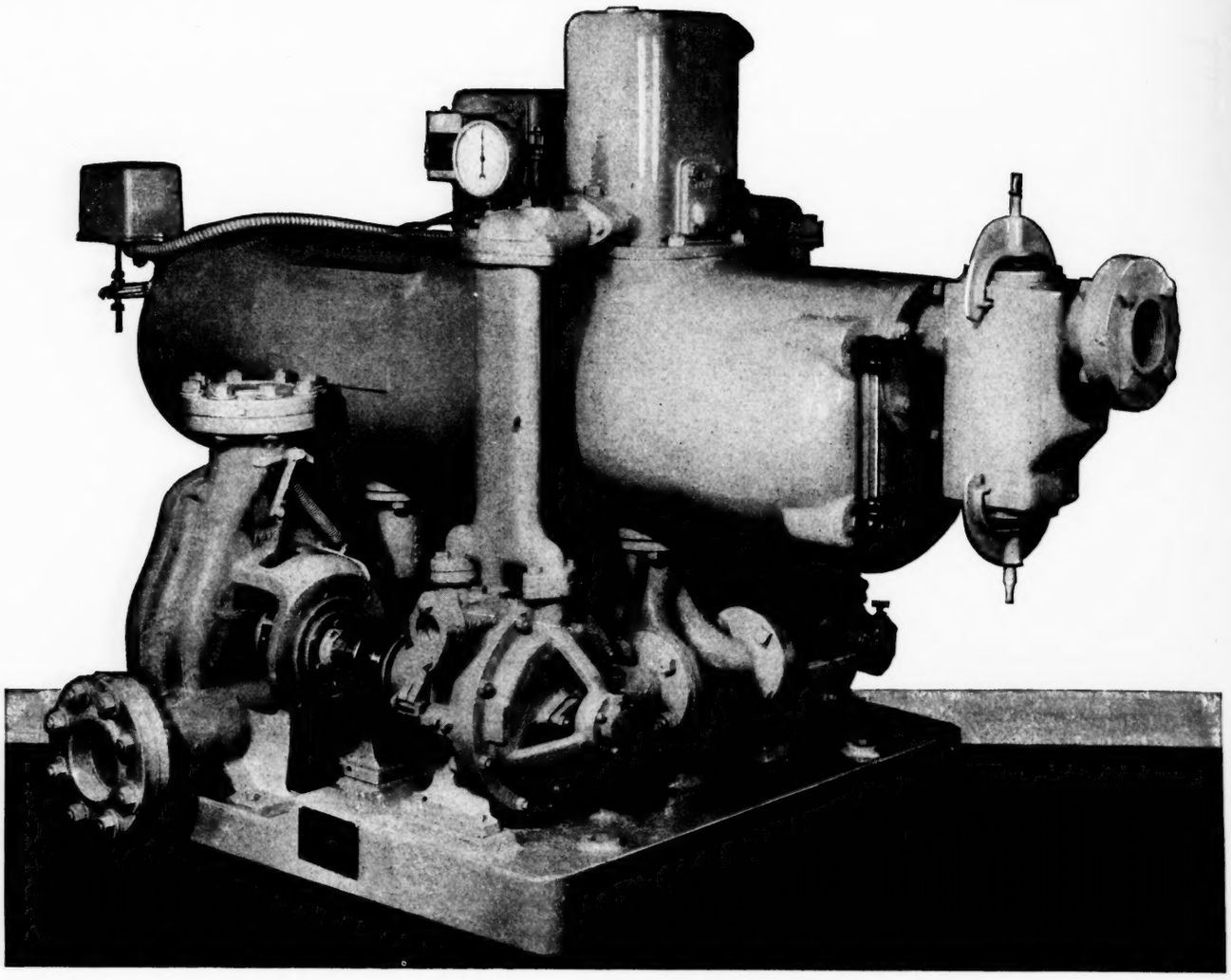

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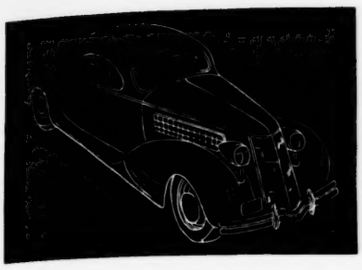
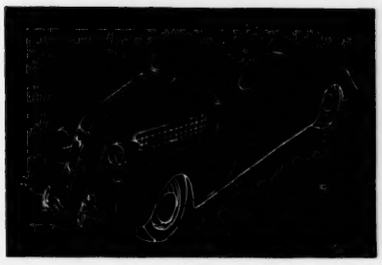


Ford Plant Adopts Air Conditioning



Motor car builder installs over 2000 tons of cooling capacity for comfort conditioning of foundries, cylinder boring department, offices, and other parts of Rouge plant at Dearborn

AIR conditioning in factory process work is an old story, but its application in the molding rooms of a foundry is news. Heretofore sand molding has been a dirty, humid job at best and improvements in foundry methods have not been along lines of bettering working conditions in such operations. With an installation in a molding room now an accomplished fact, it is likely that further careful attention will be directed toward applying air conditioning as a means of improving working conditions in other metal-working processes. It looks as if the move toward industrial comfort conditioning as contrasted with industrial process conditioning is on its way.

Certainly it is not surprising that Ford should be a pioneer in industrial comfort conditioning for the Ford factory has led the way in so many other processing innovations that the addition of air conditioning to the list is a development rather to be expected. When new tools have become necessary Ford engineers have never hesitated to develop and make use of them. It appears that air conditioning is now considered by them to have reached such a stage that it is to receive adequate consideration as a processing tool. As might be expected the results anticipated are to be found in increased efficiency of the workmen due to the constant and proper temperature and humidity and to an improved quality of the product.

While the application to molding operations is perhaps the most unusual of those so far made, it is by no means the only one. Air conditioning at the Rouge plant at Dearborn and at the nearby Ford properties has even now reached a point where the connected refrigeration capacity used for this purpose totals over 2,000 tons. The accompanying table shows where this capacity is installed and permits judging the extent and the type of refrigeration used.

Location	Tons	Refrigerant	Compressor Type
Dearborn Inn	250	Carrene	Centrifugal
Henry Ford Hospital	100*	Carrene	Centrifugal
Administration Building	260	Freon	Reciprocating
Rotunda Building	100	Freon	Reciprocating
Engineering Laboratory	640	Water vapor	Centrifugal
Foundry, Drafting Room and Trade School	520	Water vapor	Centrifugal
Diamond Bore Room	150	Water vapor	Centrifugal

*Capacity at — 10°.

From this it will be noted that the capacity installed at the factory itself is made up of the last two items in the table and totals 670 tons. By far the greater part of this has been put in during 1935.

While all the installations contain features peculiar to themselves, those in the diamond bore room and in the molding rooms are industrial comfort jobs so unusual that only they will be described here.

The Diamond Bore Room

In the diamond bore room the cylinder blocks of the V-8 engines are bored to accurate diameters. The boring operation is accomplished on gang boring machines so designed that all cylinders are bored at once. The boring tools operate at high speed and considerable power is required to feed the tools into the metal. With the number of these machines in the room there are 500 electrical horsepower required when operating at capacity. As a considerable part of this electrical energy eventually reaches the air of the room it can be seen that the amount of heat per hour added to the room air is great. A cooling compound is fed to the working points of the tools and this compound is kept at a constant temperature in order to aid in minimizing any changes of dimension with temperature change. Close-fitting metal hoods collect the fumes arising at the machines and carry them away through a separate fan-powered suction exhaust system of ducts. Fresh conditioned air for ventilation is introduced into the room and diffuses horizontally near the ceiling.

In order to pick up the great amount of mechanical and human load within this small room it is necessary continuously to recirculate all of the air within the room through 10 unit coolers equally spaced through the upper part of the room.

Foundry Molding Rooms

Although it is intended to equip and air condition six or more molding rooms in the special metal casting department—the refrigerating unit being designed with a capacity to supply cooling water for all the units necessary to air condition all rooms—but two of these rooms are now equipped and operating.

Each room contains two separate systems for the preparation of the molds for steel or special alloy castings, and occupies an area of 58 ft. x 67 ft. with a ceiling height of 16 ft., giving a volume of over 60,000 cu. ft. per room.

The equipment for each system within the room consists of two 16-ft. turntables carrying alternate cope and drag molding machines; one sandslinger for each turntable, the prepared sand being fed to the sand-

slinger from prepared sand bins in the ceiling by means of electric vibrating feeders; two inspection tables for each turntable; a monorail mold conveyor which brings the empty flasks in one end of the room to the turntables and takes the completed mold out the other end of the molding room where the casting is poured with steel or special alloy prepared in electric furnaces. Within the room for full production on the four turntables there would be about 60 men.

Each of the rooms is completely enclosed with sash and gunite, with a concrete ceiling which serves as an operating floor for the sand preparation. The air within the room is conditioned by two unit type conditioners equipped for all year operation.

Fresh air is drawn from the outside of the building through screened and louvered openings and passes through tempering coils of the fintube type to a mixing chamber above the air conditioned room, where the fresh air is mixed with the recirculated air. The recirculated air is drawn from the ceiling of the air conditioned room through a louvered opening. Under normal operating conditions the system will use one-half fresh air and one-half recirculated air.

The mixed air then passes through oil filters of the rolling apron impingement type, thence the mixed and filtered air passes through a main duct to the air conditioners which are located underneath the ceiling of the air conditioned room. There are two conditioner units for each room, each conditioner has cooling coils and heating coils of the fintube type, balanced air mixing dampers, humidifier, and fans, and handles 6,600 c.f.m.

For winter operation, the units are capable of heating and humidifying, by a jet type humidifier, to maintain a temperature of 68° dry bulb and a 45% R.H. in the rooms.

For summer operation the cooling coils are capable of cooling and dehumidifying the air to the point necessary to maintain a condition in the rooms 10° to 15° below outside temperature and not to exceed 50% R.H.

Water, supplied from a water vapor type refrigerating plant, enters the conditioner units at a temperature of 45° and leaves at a temperature of 51°, each unit having a capacity of 18 tons refrigeration effect.

Separate automatic control for each unit is of the pneumatic type, a thermostat with throwover switch for summer and winter operation being used for controlling the air mixing dampers and diaphragm valve on the steam line to heater, and a humidistat for controlling the diaphragm valve on the steam line to the humidifier for winter use.

The conditioned air leaves the conditioner units through sheet metal distributing ducts at the ceiling and passes through high velocity slotted grilles into the room. The conditioned air leaving the slotted grilles at high velocity mixes with the air in the room, giving an even distribution of the air.

The rooms are kept under a slight pressure, so that at any opening in the molding room, as where the mold conveyor enters or leaves, there will be a small flow of air from the room into the foundry proper.

Split System Cools Utility Office

IN June of this year, equipment was installed to condition the air for the "customers" floor of the office building of The Stamford Gas & Electric Company.

The conditioned space has a total volume of 130,000 cu. ft. with large plate glass windows and vestibuled entrances forming the north and east sides. On this floor are found the cashier's counter, application department, credit department, and a large area devoted to appliance display. The total heat load figured 250,000 B.t.u. per hr.

The equipment selected consists of a silica gel dehumidifier equipped with fans and aftercooler which operates in conjunction with a refrigerating compressor connected to standard cooling coils. The capacity of the system is 11 tons latent and 10 tons sensible heat removal, or a total of 21 tons.

Three thousand cubic feet per minute of fresh air from the roof of the building is drawn through the dehumidifier and the aftercooler. This air enters a chamber where it mixes with 2800 c.f.m. of recirculated air and then passes through a filter to the cooling coils, and thence through the main fan to the discharge ducts located over the windows on the customers' floor. Two large return ducts bring that part of the air to be recirculated to the mixing chamber.

Cooling water for the aftercooler and the compressor is taken from the Stamford Water Company's mains and is run to waste after being used. A test made during the summer of 1934 indicated a water temperature of 74°, but due to the unusual hot weather in 1935 the average temperature of the inlet water during July and August was 79, which has the effect of increasing considerably the amount of cooling water required. The matter of an indoor or roof type cooling tower was considered, but action was deferred until there was an opportunity to determine just how much the water consumption might be reduced without using a tower.

An unusually hot summer with high humidity provided a good test for the equipment. Except for minor difficulties, such as may be expected with newly installed automatic apparatus, the system functioned perfectly. By maintaining a relative humidity of 40%, it was possible to keep well within the comfort zone with the indoor dry bulb temperature 3 to 5° below outdoor temperatures.

Month	Gas Used, Cu. Ft.	Water Used, Cu. Ft.	Electricity Used, Kw-hr.
July	225,600	104,500	7,136
August	211,400	94,900	6,488

The figures for July and August are given above. The dehumidifier burned 528 B.t.u. gas at the rate of 1000 cu. ft. per hr. when operating. The total connected load in motors was 18⅛ hp.

Air Conditioning of Motor Vehicles

Test car used as proving ground for development of air conditioning system for motor vehicles. Ralph F. Peo, engineer-executive, shown about to enter standard passenger car which has been driven 12,000 miles in process of developing principles of complete air conditioning. Coil on top of car is a condenser intended for use primarily on buses.

By RALPH F. PEO† and
E. P. HECKEL‡

A description of a new system developed especially for buses, and applicable with modifications to private cars, taxicabs and ambulances. Abstracted from a paper presented by the authors before the annual convention of the National Association of Bus Operators held in New Orleans, October 25.

WE are considering in this brief presentation the practical and commercial application of general summertime air conditioning for use on self-propelled motor vehicles, with special reference to motor transport, namely, the generation of properly cooled, dehumidified air, cleaned of impurities and circulated within the vehicle in such a manner as to bring an optimum of comfort to passengers. We are not concerned with ventilation alone, nor of cooling without the removal of atmospheric moisture, nor of air cleaning only, but a combination of all these functions, scientifically coordinated—in a word, true and genuine air conditioning, measured by the standards set up for railroad cars and commercial buildings.

Features

The Houdaille-Carrier engineering development work has been directed to the perfection of a system that would be (1) efficient; (2) compact; (3) absolutely safe in operation; (4) free of service difficulties; (5) economical in first cost and economical in operating cost.

The system to be most useful must be efficient and compact as the bus operator does not want to add any more burden to his operating costs than absolutely necessary, nor does he wish to sacrifice valuable passenger fares for air conditioning equipment.

Of predominant importance to bus operators is the question of the safety of passengers. The Houdaille-Carrier system utilizes the refrigerant Carrene. The refrigerant charge required for a bus will be approximately a gallon. It is not subject to excessive loss within the system due to the fact that the system operates below atmospheric pressure. The initial charge should, therefore, last indefinitely, as has been demonstrated.

It is very evident that any system of air conditioning for vehicles should be as free of service difficulties as possible, more so than a system installed in a building, as the motor bus or car will be at times where service will not be available. In the case of the motor bus, we have kept in mind that time is not available for service except at the ends of runs, as schedules must be maintained. In this development work, we have eliminated as many moving parts as practical as well as automatic devices that would require servicing.

Refrigeration

The system for vehicle air conditioning utilizes a low pressure refrigerating compressor having no reciprocating and very few moving parts. The power for the compressor is low and is supplied by the bus or car engine. The compressor supplies the refrigerant to the cooling unit or evaporator located within the bus. A small motor-driven fan draws the air from the vehicle over the evaporator and circulates it within the vehicle's interior, while at the same time drawing in an adequate amount of outside air to provide proper ventilation at all times. The liquid refrigerant, while passing through the cooling coils, where it extracts heat and dehumidifies the air, is converted from a liquid to a vapor. The vapor is then cooled in an air cooled condenser unit which is mounted outside the passenger compartment so that the movement of the vehicle provides the required passage of air over the condenser coils. The refrigerant vapor thus condensed and cooled, having given up its heat to the outside atmosphere, is returned to a liquid receiver and the refrigerating cycle is repeated.

Extensive experimental tests in typical automobiles enable us to predict with reasonable accuracy the effect of air conditioning on buses. The design is such as to provide a dry bulb temperature within the vehicle of from 10° to 15° below outside temperature conditions on hot days. This is in conformance with standard practice in railroad cars, theaters, and other buildings. Positive dehumidification of the air is accomplished, the general effect being fully equal to the

†Vice-President, Houde Engineering Corp., Buffalo.
‡Vice-President, Carrier Engineering Corp., Chicago.

accepted standards usual in the better stationary installations for human comfort.

Distribution

Distribution of the conditioned air in the bus may be accomplished either by a short length of duct along each side or down the center aisle at the ceiling level. Air discharge outlets with individual control may be placed in these ducts diffusing the air downward over the passengers. Initial tests indicate the distribution of about 1500 c.f.m. of air, or approximately 50 cu. ft. per passenger with 25% outside air, sufficient to dissipate odors and dilute smoke. The outside air intake will be fitted with filters for air cleaning, so that all the necessary functions of complete summer air conditioning are performed. For winter heating requirements as may be necessary in some climates, a heating coil may be installed utilizing the same duct system for the purpose of circulating filtered and heated air within the bus, thus making for complete year 'round air conditioning service.

Size and Capacity

For those who are more technically inclined, let us consider a typical long haul passenger bus seating from 32 to 35 passengers. A bus having the engine mounted in front will have the following approximate interior dimensions: 26 ft. long, 7 ft. wide, and a maximum height of 6¾ ft. The contents will be about 1,200 cu. ft., the external body surface 630 sq. ft., and the glass surface approximately 115 sq. ft. The estimated cooling load of a bus of good tight construction with the roof insulated and properly painted is approximately 60,000 B.t.u. or five tons of refrigeration.

The heat given off by 35 passengers at rest amounts to approximately 14,000 B.t.u. an hr., whereas the air drawn in from the outside for ventilation and the infiltration will be about 12,000 B.t.u. Our experience has shown that the sun load, the heat from the engine, and the infiltration of outside unconditioned air are the largest contributing factors and the most important to consider in estimating the cooling load. The bus operator can readily see that it is, therefore, very essential that more consideration be given to the matter of bus insulation in the future in order to obtain the most effective air conditioning with greatest economy.

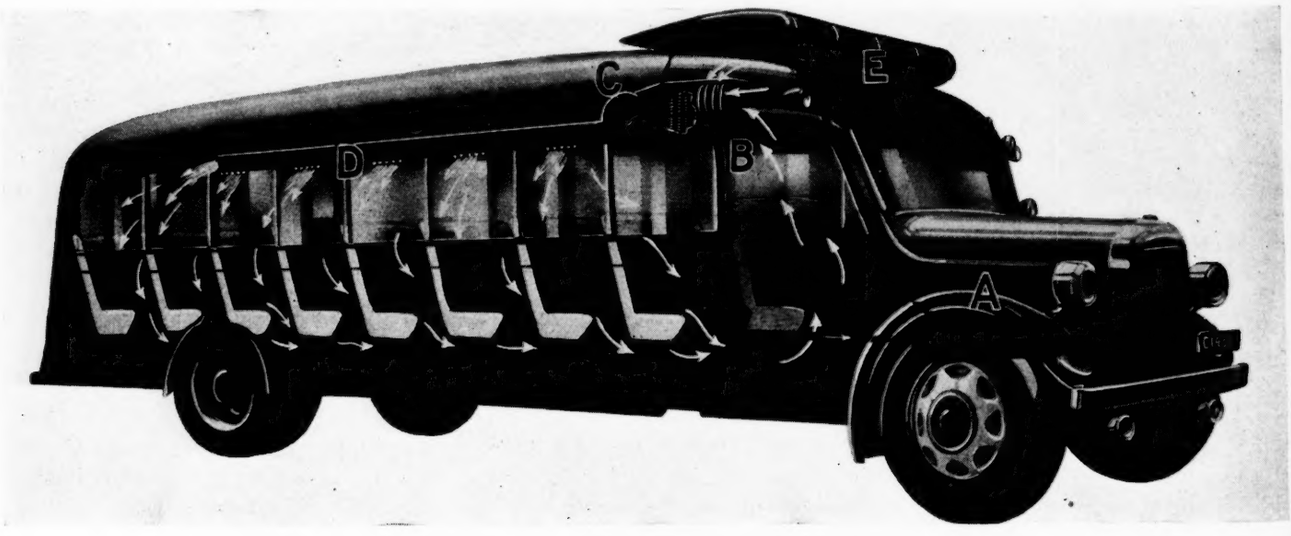
In developing this system of air conditioning as applied to existing vehicles, it has been found advisable to insulate the engine compartment from the bus proper, insulate and paint the roof a light color and stop up all cracks where the outside unconditioned air would otherwise tend to filter into the car. Money spent for insulation or construction tending to reduce the size of the cooling plant will be a good investment, as the weight of the equipment and operating cost will be reduced and better cooling can be expected.

The experimental apparatus thus far developed indicates that a system for the type of passenger bus we have taken for our example should weigh something less than 600 lb. and will take less than 6 hp. to operate. The compactness of the system may be indicated by the statement that all the elements will occupy a combined space of less than a 3-ft. cube. Cost of operation is practically negligible since the prime motive power is already available in the car engine.

The standard bus construction is well adapted to the installation of the system described. The cooling units or evaporators can be placed inside the bus without sacrificing any passenger space. The condenser cooling coil may be placed on the roof of the bus and can be streamlined to harmonize effectively with the general design of the vehicle. This condenser unit may be kept to less than 15 in. in height which will not interfere with necessary clearance, and identifies the vehicle as one being air conditioned.

The problem of installing air conditioning in new buses or other vehicles is vastly simplified, for it will permit a design exactly fitted to the requirements, provide in advance for proper insulation, permit the use of double windows, light reflecting shades and painting that will tend to reduce sun heat pickup to a minimum.

It will be recognized that the taxicab, private ambulance, and private automobile also offer a notable field of application.

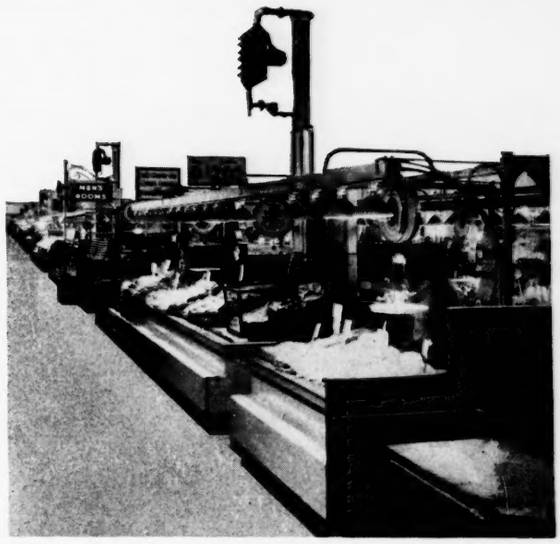


DIAGRAMMATIC SKETCH OF AIR CONDITIONED BUS

(a) Refrigerating compressor driven by car engine which supplies refrigerant to cooling coil. (b) Provided with intake and filter for outside air. Fan (c) draws air over coil where it is cooled and dehumidified, then distributed by duct (d). Outlets in bottom of the duct diffuse conditioned air downward over passengers. Condenser cooling coil (e) is on roof It will require 5 tons of refrigerating capacity to cool typical 35-passenger bus.

Methods of Controlling Industrial Unit Heaters

By R. S. DAWSON†



A brief and simple discussion of four methods of controlling unit heaters with advantages and disadvantages of each. The author concludes that the selection of a particular type depends on the requirements of a specific job and the amount of money available for investment in controls.

IN view of the present wide use of unit heaters and a tendency to still greater utilization of this type heating surface, some discussion of the various means employed to secure automatic control in this field seems desirable. This subject has become a more important factor since unit heaters have been more widely applied to offices, stores, and factory workrooms where close temperature control is desirable.

There is an important difference between a space heated by unit heaters and one heated by radiators. Heat distribution is obtained with wall or standing radiators largely by gravity circulation of room air, and the temperature difference between floor and ceiling is relatively constant. Heat distribution with unit heaters is entirely dependent on the air current created by the fan. With fan operating, the temperature difference between floor and ceiling is generally less than with radiators, but with the fan *not* operating the temperature difference will be extremely greater. This is an important control factor and one which is usually neglected in considering this subject.

Intermittent Fan Control (Fig. 1)—This method is the one in widest use and consists simply of an electric wall thermostat which starts and stops the unit heater fan according to changes in room temperature. This method gives satisfactory results in most cases.

When the fan stops, excessive stratification and temperature difference may develop under certain conditions. This is due to the fact that the unit method of heating is dependent on fan operation for heat distribution. At the conventional 5 ft. thermostat level the temperature may be sufficient to satisfy the thermostat setting, and no heat is supplied. Below this level, workers at desks and benches may experience a very disagreeable drop in temperature before the fan is turned on again by the thermostat ("cold 70"). This is particularly true in rooms with glass exposures. There may also be objections to the wide variation in air movement in some cases. Lowering thermostats on wall to the body level of the room occupants is desirable, but this will not eliminate cold air falling from glass surfaces when the fan is stopped.

Intermittent Fan and Steam Control (Fig. 2)—This method is a combination of thermostat control and motor operated valve in the steam line. Steam is shut off to unit heater when fan stops. The method is not widely used because of the high initial cost of apparatus and wiring. Some savings are effected by having the steam turned off when heat is not required. These savings are not so high as might be supposed, due to the fact that steam consumption of the unit heater with fan off is approximately only one seventh of the steam consumption with fan running.

Variable Speed Fan Control (Fig. 3)—This type of control is not truly automatic, for the fan speed must be changed as heat loss varies. The usual method is to employ a two- or three-speed fan with a switch

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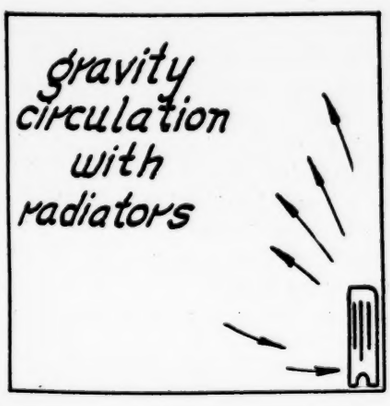
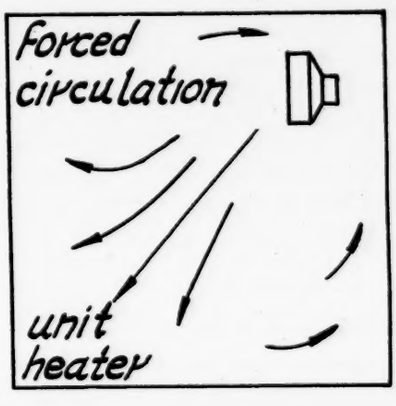
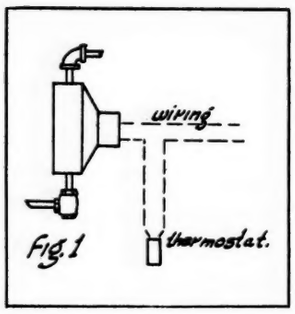
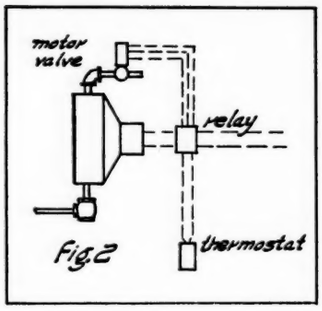
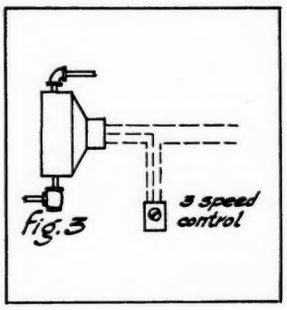
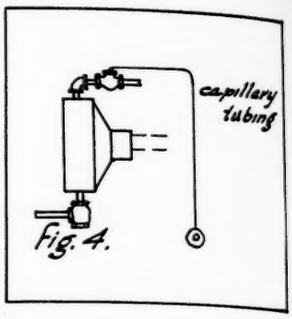












located on the wall to provide a quick means of adjustment. Fan speed must be changed manually, as heat requirements vary, and no thermostatic regulation is obtained. However, due to the fact that the fan is continually operating, even heat distribution is secured. Initial cost of this type equipment will run higher than the wall thermostat, but less than the combination of wall thermostat and motor valve.

Direct-Acting Steam Control (Fig. 4)—This method employs a valve in the steam supply to the unit heater which is actuated directly by a wall thermostat through small capillary tubing. Contraction and expansion of the liquid in the wall thermostat modulates the steam flow to the temperature requirement of the room as determined by the thermostat setting. Control within 1° is secured. Heat distribution throughout the heated area is uniform as the fan runs continuously. No control wiring is required. The objection to this type control is that it cannot be used on one-pipe systems. Initial cost of this equipment is about the same as variable speed fan control.

In all the above control methods it is good practice to use a thermostat or aquastat of the clamp-on type fastened to the drip line. This is wired in series with the fan motor to prevent blowing cold air when there is no steam in the unit.

On unit heaters connected to gravity return systems (not equipped with vacuum return pump), it is advisable to provide a vacuum breaker to prevent trapping condensate in the heater. The vacuum-breaker may be in the form of a quick-vent, or a check valve to open inwardly. This applies regardless of the control system on very low steam pressures, and applies particularly to the direct-acting control system regardless of steam pressure.

Each system has advantages. Selection of the type best suited depends on the particular requirements of the job, and the amount to be invested in controls.

$5 Million in Heating Jobs for 44 Federal Housing Projects

THERE are 44 Federal Housing projects now being installed in 31 cities throughout the country under the direction of the Federal Housing Administration of Public Works. These projects will total 23,528 living units, provide space for nearly 80,000 people, cover almost 960 acres, and total over $116 million in cost. Making allowance for those projects which are situated in the south it is probable that the cost of heating installations for these projects will run about $5 million.

The Housing Division of PWA has as its aim a demonstration of slum clearance and the advantages to be gained from such work. The PWA program consists mainly of projects wholly financed by the Federal Government to be constructed and operated through its Housing Division.

The accompanying tabulation gives the pertinent facts relating to the projects now under way. All projects which are not included in this listing have been indefinitely suspended.

Allotments for Federal projects include a 45% grant, the project rentals to repay the balance to the Government over a 60-year period of amortization. Rent terms will be determined by the final cost of the project, each development being technically planned to keep charges commensurate with those now being paid for substandard shelter.

The tabulation does not include seven housing developments erected by private limited dividend corporations operating under PWA loans under the division's supervision.

These limited dividend projects include:

(1) The Alta Vista Housing Corporation projects in Alta Vista, Va., consisting of small single-family frame houses containing 50 living units now completely occupied. Cost, $84,000.

(2) Hillside Housing Corporation project located in the Bronx, N. Y. Apartments containing 1,416 living units. Completed. Cost, $5,060,000.

(3) Euclid Housing Corporation project in Euclid, Ohio. Individual and double houses; 34 houses completed and occupied, nine under construction. George B. Mayer, Cleveland, is the architect. Cost, $500,000.

(4) Carl Mackley Housing Corporation in Philadelphia. Three-story apartments containing 284 living units. Project completed. Cost, $1,039,000.

(5) Boulevard Gardens project in Queens, N. Y. Six-story apartment containing 960 living units. All apartments rented as of September 8. Cost, $3,450,000.

(6) Boylan Housing Corporation project in Raleigh, N. C. 54 living units—an apartment house—all of which are rented. Cost, $198,000.

(7) Neighborhood Gardens project in St. Louis. 252 living units in apartments, 48 of which were completed and rented as of September 30. Cost, $640,000.

STATUS OF HOUSING PROJECTS OF THE FEDERAL EMERGENCY ADMINISTRATION OF PUBLIC WORKS—AS OF OCTOBER 2, 1935

City and Name of Project	Type	Size	Architect and Contractor	Status—October 2, 1935	Cost
Atlanta—Techwood ...	3-story dormitory, 2-story row houses, 3-story apartments	604 living units 25 acres	Burge & Stevens, Atlanta, architects; J. A. Jones Construction Co., Charlotte, N. C.	Construction 62% complete	$2,875,000
Atlanta—University ...	2- and 3-story flats and row houses	675 living units 19 acres	Edwards & Sayward, Atlanta, architects; N. P. Severin Co., Chicago, contractor	Construction 90% complete	2,500,000
Atlantic City—Site A..	2-story flats and row houses	337 living units 8 acres	J. V. Mathis, chief architect	Site acquired. Demolition bid accepted Sept. 19	1,700,000
Birmingham—Smithfield Court	1- and 2-story row houses, 3-story walk-up apts.	712 living units 28 acres	D. O. Whilldin, Birmingham, chief architect	Site under option	2,500,000
Boston—Old Harbor Village..	1- and 2-story row houses, 3-story walk-up apts.	1,191 living units 30 acres	J. D. Leland, chief architect	Site being purchased	6,000,000
Buffalo—Lang Field ..	1- and 2-story row houses, and flats	893 living units 65 acres	Chester Oakley, chief architect	Site under option	4,500,000
Cambridge—Main Street	2-story row houses and flats and 3-story apts.	579 living units 7 acres	—	Site under option	2,500,000
Camden—Westfield	2-story row houses and flats, 3-story apts.	595 living units 7 acres	—	Site under option	2,500,000
Charleston—Meeting Street	1- and 2-story row houses	291 living units 22 acres	Samuel Lapham, chief architect	Site under option	1,150,000
Chicago—Jane Addams Houses.	3-story apts.; 2-story row houses	304 living units 6 acres	John A. Holabird, chief architect	Site acquired	1,500,000
Chicago—Diversey	3-story apts., 2-story row houses and flats	1,042 living units 38 acres	Robert De Golyer, chief architect	Site acquired	6,000,000
Chicago—Trumbull Park	2-story row houses and flats; 3-story apts.	550 living units 22 acres	—	Site under option	3,250,000
Cincinnati—Basin Housing	3- and 4-story apts.	1,278 living units 24 acres	F. W. Garber, chief architect	Site being purchased	6,500,000
Cleveland—Cedar Central	3-story apartments	654 living units 18 acres	Walter McCornack, Cleveland, architect; George A. Fuller Co., Washington, contractor	Construction 5% complete	3,279,000
Cleveland—Outhwaite ..	2- and 3-story apts., flats and row houses	635 row houses 21 acres	Maier, Walsh & Barrett, Cleveland, architects	Construction bids opened Aug. 28	3,650,000
Cleveland—West Side..	2-story row houses and 3-story apts.	597 living units 22 acres	J. L. Weinberg, Cleveland, architect	Bids opened Sept. 4	3,800,000
Columbia, S. C.—University Terrace ..	1- and 2-story row houses and flats	162 living units 4 acres	J. B. Urquhart, architect	Site under option	500,000
Dallas—Lucas Drive...	1- and 2-story row houses	215 living units 17 acres	W. C. Sharp, chief architect	Site under option	900,000
Detroit—Chandler Park	3-story apts.; 2-story row houses and flats	893 living units 31 acres	—	Site under option	4,500,000
Detroit—East Side.....	3-story apts.; 2-story row houses and flats	1,032 living units 64 acres	G. D. Mason, Detroit, chief architect	Site being assembled	5,500,000
Indianapolis—Community Housing.	2-story row houses, 2- and 3-story apts.	1,044 living units 22 acres	W. L. Russ and Merritt Harrison, architects; N. P. Severin Co., Chicago, contractor	Construction 1% complete	3,025,000
Jacksonville—Durkeeville	1- and 2-story row houses	253 living units 20 acres	M. C. Greeley, chief architect	Site under option	1,000,000
Lexington, Ky.—Blue Grass Park ...	1- and 2-story row houses and flats	350 living units 67 acres	Hugh Meriwether, chief architect	Site acquired	1,500,000
Louisville			—	Appeal to U. S. Supreme Court pending	—
Louisville—Algonquin Parkway..	1- and 2-story row houses	278 living units 14 acres	E. T. Hutchings, chief architect	Site acquired	1,200,000
Louisville—Seventh Street	1- and 2-story row houses	125 living units 5 acres	E. T. Hutchings, chief architect	Site acquired	700,000
Memphis	1- and 2-story row houses and 2-story apts.	635 living units 39 acres	J. F. Smith, chief architect	Site under option	3,200,000
Memphis	1- and 2-story row houses and 3-story apts.	694 living units 25 acres	J. F. Smith, chief architect	Site under option	3,000,000
Miami—Sixty-Second Street ..	1-story row houses	255 living units 60 acres	Paist and Steward, Miami, architects	Site under option	1,000,000
Milwaukee—Parklawn..	3-story apts. and 2-story row houses	458 living units 42 acres	G. J. De Gelleke, chief architect	Bids opened Oct. 15	2,800,000
Minneapolis—Summer Field	2- and 3-story apts. and row houses	694 living units 26 acres	W. H. Tusler, chief architect	Site being purchased	3,500,000
Montgomery, Ala.—Bell Street	1- and 2-story row houses	100 living units 14 acres	W. A. Ausfeld, H. B. Jones, architects; T. L. James & Co., contractor	Contract awarded Sept. 24	416,000
Nashville	1- and 2-story row houses	377 living units 18 acres	R. R. Clark, chief architect	Site acquired	1,700,000
Nashville	1- and 2-story row houses and standard 2-story flats	361 living units 22 acres	R. R. Clark, chief architect	Site acquired	1,500,000
New York—Williamsburg	4-story walk-up apts.	2,029 living units 21 acres	R. H. Shreve, chief architect	Site being purchased	12,783,000
New York—Harlem McCombs Place	4-story walk-up apts.	725 living units 8 acres	A. M. Brown, chief architect	Site under New York City condemnation	4,700,000
Oklahoma City	1- and 2-story row houses	539 living units 18 acres	J. O. Parr, architect	Site acquired	2,000,000
Omaha—North Side ..	1- and 2-story flats	483 living units 15 acres	W. L. Steel, chief architect	Site under option	2,000,000
Philadelphia—Hill Creek Park ...	1- and 2-story row houses; 2-story flats; 3-story apts.	340 living units 24 acres	W. H. Thomas, chief architect	Site under option	1,800,000
Stamford, Conn.—Fairfield Avenue	1- and 2-story row houses; 3-story apts.	165 living units 5 acres	W. J. Provoost, architect	Site under option	800,000
Washington—Langston Terrace ...	2-story flats and row houses; 3-story apts.	322 living units 13 acres	Robinson, Porter & Williams, architects	Site acquired	1,600,000
Washington—Anacostia Terrace ..		—		Site acquired	60,000
Wayne, Pa.—Highland Ave.	2-story row houses and flats	62 living units 2 acres	H. B. Register, chief architect	Site under option	300,000

Well Insulated Residences Heat Differently

By WILLIAM M. HOUGHTON

THERE is no doubt but that the trend in residential building methods will continue to be toward more and more heat-proof construction. The increasing use of the more expensive fuels emphasizes the desirability of making an investment in insulation and tight construction that will yield a return in lower fuel costs. The remarkable public interest in air conditioning spreads the realization that buildings put up today must be capable of economical summer cooling in order to avoid early obsolescence. The public is now pretty generally aware of the desirability of caulking, weatherstripping, and a certain amount of insulation. The use of really adequate insulation is becoming more general, and double glazing or double sash will undoubtedly be applied in increasing quantity.

This trend makes it interesting to consider the fact that the tight, well-insulated house has rather different heating and cooling characteristics from those of the leaky and uninsulated house. The first and very obvious difference is that the heat losses will be less and that the heating plant may therefore be made smaller. In spite of the obviousness there are still a great many heating contractors who will shake their heads and recommend that the heating plant be sized as though the insulation were not there. There is hardly any factor in the design of a heating installation, the effect of which can be as definitely predicted as the use of insulation in the building construction, and to ignore or mistrust its effect is simply bad engineering. The progressive contractor realizes that while insulation reduces the amount of radiation and the size of other heating equipment he sells for a given job, it gives a more satisfactory installation, from the point of view of the owner, and is better for the industry in the end.

The second and less widely appreciated difference is in the ratio between heat losses, or capacity of the heating plant, and heat storage capacity of the building. As between two houses, otherwise similar but one insulated and the other not, the insulated house will have a smaller heating plant but may have a somewhat greater heat storage capacity. Because of both these factors it will be impossible to raise the building temperature as rapidly, and because of the smaller heat losses and the greater thermal capacity the building will not cool as rapidly. In other words this house is more unwieldy, in a heating sense, than the uninsulated house. The resistance to temperature change is as great or greater, while the means available to produce temperature change is less powerful. It is like putting a larger flywheel on a smaller engine.

The temperature chart shown in Fig. 1 illustrates, among other things, the difference in cooling rate mentioned above. This is from an actual recording thermometer chart, taken in a Pittsburgh residence insulated with corkboard. Notice the slope of the room temperature line after the thermostat was turned to the night setting on Friday night. Compare it with the dotted line, which is copied from a similar chart taken the same night in a nearby, uninsulated house. The temperature line in the uninsulated house is much steeper than that of the insulated house. The insulated house cooled at a rate of somewhat less than 1½° an hour, while, under the same conditions, the uninsulated house cooled at about 2.15° an hour.

This "heat inertia," or resistance to temperature change, while it may be exaggerated in the case of tight, well-insulated houses, is an important factor in the control of temperature in any building. In office buildings, churches, and other buildings that are intermittently occupied it is a property that we might be glad to do without, for these buildings are often left unheated overnight or for longer periods, and heat inertia makes them slower and more expensive to warm up again.

But heat inertia has its uses, and, especially in the residential field, it is, on the whole, an advantage, for a residence is continuously occupied, and the night period during which a lower temperature can be main-

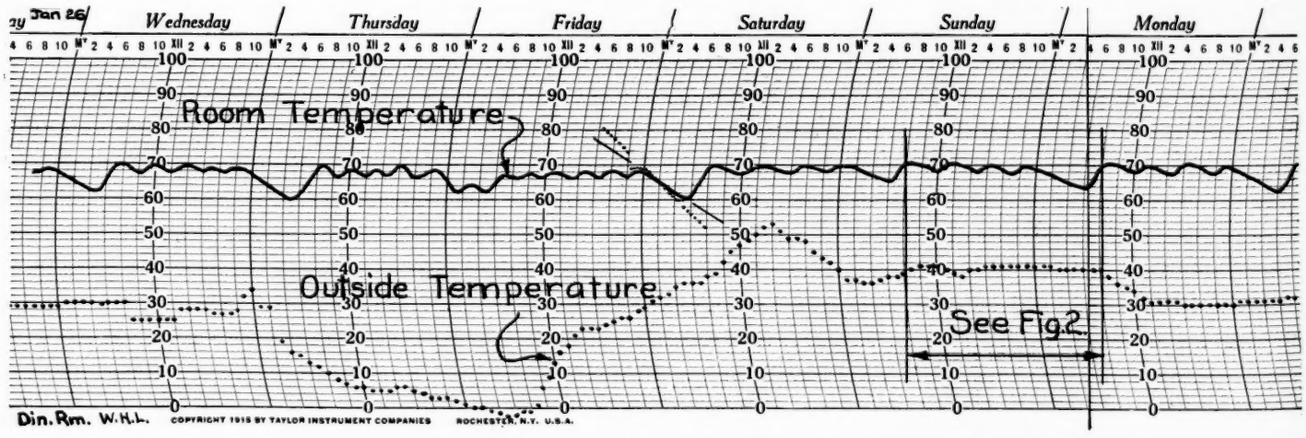


Fig. 1. Room temperatures in an insulated house with thermostatic setting lowered at night.

tained is short. Heat inertia delays the effect on room temperature of sudden fluctuations in outside temperature. Thus in extreme weather, when the heating plant is taxed to its limit, the heat stored in the building will carry it over a short period of unusual severity, beyond the capacity of the heating plant, with little drop in room temperature. And when, for instance, a door is left open for a few minutes and a large quantity of cold air is admitted, this air will be quickly warmed to room temperature by heat stored in the building and its contents.

It is fortunate that the characteristics of heated buildings lend themselves to the maintenance of steady room temperatures, for this condition is, of course, necessary to the greatest comfort of the occupants. Furthermore it can be shown that maximum comfort requires not only constant temperature at the thermostat but a reasonably constant supply of heat and adequate air circulation. Control manufacturers are bending their efforts to achieve these results, and a number of improvements on the simple room thermostat are appearing.

In the light of the slower heating and cooling rates of the modern tight and well-insulated house it seems desirable to reconsider the matter of the advisability of reducing room temperatures at night. This question has been argued long and loudly between those who believe in the practice and those who do not. There are two advantages to justify the extra cost of the controls and the adverse effect on the furniture: fuel economy, and cooler bedrooms during sleeping hours. The obvious way to make bedrooms cool at night is to shut off the radiators or warm air registers. Most thrifty householders object to trying to heat the great outdoors all night by leaving heat on while the bedroom windows are open. Radiator valves and warm air shutters should be designed to shut off as easily as possible. There is no good reason for not putting the flow connections of hot water radiators at the top, where the valve can be reached without stooping to the floor, and there is no excuse for valves that can only be turned by a strong arm and a firm grip on a smooth and all-too-small handle. Nor is there any reason, other than a trifling economy, why the handles of baseboard air registers cannot be extended up to a convenient distance from the floor, in bedrooms, if nowhere else.

As to fuel economy, estimates vary with the estimator and are often based on false reasoning. We have heard it argued something like this: "By shutting down your thermostat, and hence your burner, at ten, and putting it up again at six, your burner will operate very little, if at all, during eight hours of the twenty-four, or one third of the time—." The resultant saving quoted depends on the euthusiasm of the estimator, but is usually very attractive. There are evident fallacies in this method of estimating. Incidentally, if you can actually set up your thermostat at six on a cold morning and have the house warm by seven you undoubtedly have an overgrown heating plant and are burning fuel at an excessive rate.

Most automatically fired heating plants deliver heat at a fixed rate which must be at least adequate to hold the room temperature constant under the most severe weather conditions for which the plant is designed. For purposes of raising the building temperature on any given morning we have only the heating capacity proportional to the difference between weather conditions then obtaining and design conditions, this capacity disappearing as the weather approaches its maximum severity. The rate at which the building temperature can be raised, and hence the time required, will vary according to the weather. Theoretically, therefore, the hour at which the day setting of the thermostat must be restored should be made earlier as the weather gets colder. When maximum design conditions obtain the thermostat setting must not be reduced at all as it is then impossible to bring the room temperature up again.

It thus appears that reducing room temperature at night is impractical in severe weather, and that in any weather ample time must be allowed in the morning for restoration of the day temperature.

The soundest method of estimating possible fuel savings, though still not without possible inaccuracies, seems to be to approach by way of the heat losses from the building. As all heat lost from the building must sooner or later be replaced by the expenditure of fuel, the fuel saved will be in proportion to the reduction of heat losses. The heat losses will vary pretty closely according to the difference between inside and outside temperatures. Fuel savings will result when, and only when, the temperature inside the building is actually reduced, and in proportion to the length of time it is so reduced.

Now recall that the more heat-proof a house is the longer it takes for it to cool down and the longer it ought to require to reheat it. Refer again to Fig. 1. In this house it seems to have been the practice to set the room thermostat at 69° during the day and reduce it to 61° at night. Even though the week covered by the chart was a cold one, as shown by the lower (outside temperature) curve, the burner was operated only once during the week while the thermostat was on the night setting, and on that night the outside temperature went below zero and the night setting of the thermostat seems to have been raised slightly. On Wednesday and Friday nights, when the outside temperatures were in the twenties and thirties, the room temperature just about reached the night setting by the time the day setting was restored. On Saturday evening the owner appears to have had company and kept the thermostat at the day setting until about 12:30 or 1:00 with the result that when the day setting was restored Sunday morning the room temperature had fallen only to 65½°. It is evident that a gross error will be introduced if fuel savings are calculated on the basis of maintaining a room temperature equal to the night setting of the thermostat during the time the night setting is in effect. Even in an uninsulated house a large part of the night period may be consumed in getting the room temperature down and back again, greatly reducing the saving in heat losses.

The temperature chart of Fig. 1 can be used to make

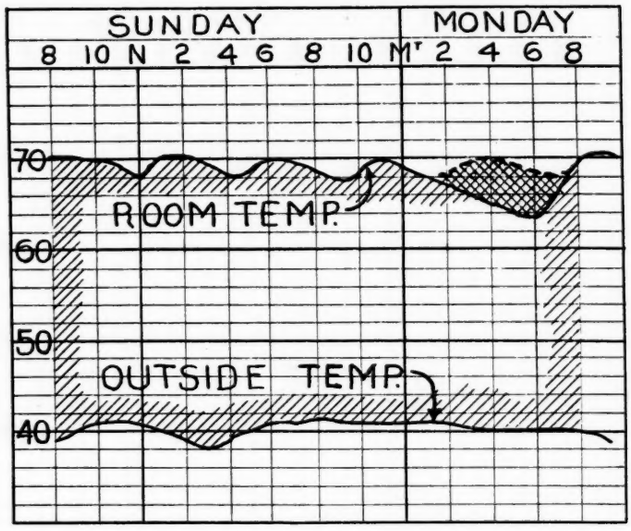


Fig. 2. Chart areas illustrating percentage reduction in heat losses due to lower right setting of thermostat.

a very good estimate of possible fuel savings. Consider the 24 hr. from 8 a.m. Sunday to 8 a.m. Monday. It so happens that the outside temperature during the whole of this period was remarkably steady and very close to the seven-months' average for Pittsburgh of 40.8°. The performance on this day may therefore be considered average for the season and typical of insulated houses in this climate. This part of the chart has been enlarged and shown separately in Fig. 2. The vertical distance between the room temperature and outside temperature lines at any time represents that difference in temperature which produces heat loss from the building, and therefore may be considered proportional to the rate at which heat is being lost at that moment. Horizontal distance on the chart represents time. The *area* between the two temperature lines over any given time interval will therefore be a measure of the heat lost and hence of the fuel that will be burned to keep the house warm during that time interval.

In Fig. 2 the short dotted section has been added to the recorded room temperature line to indicate what the room temperature probably would have been if the thermostat setting had not been reduced. The double cross-hatched area between the dotted curve and the solid curve represents approximately the heat that was saved by cutting down the temperature at night. The large single cross-hatched area represents the total heat loss, and hence the total fuel expenditure for the 24 hr. in question. Measuring these two areas with a planimeter and taking their ratio gives us, as a good general average saving to be expected in insulated houses, the disappointing figure of 3.4%. This saving might also be realized by dropping the room temperature a little more than one degree, and is scarcely enough to justify any expenditure for more elaborate control equipment.

It may be argued that the use of a single record in drawing a general conclusion is unwarranted. Unfortunately, it is very unusual to get a good record that can be used for this purpose. On the whole we feel that the result here arrived at is trustworthy. If you are considering the question of cutting down house temperatures at night, unless your house is uninsulated and leaky, the author's advice is: "Forget it."

Air Conditioning to Increase Factory Output in Hot Weather

DIFFERENT seasons of the year influence the fatigue or productivity of plant operators. This is especially true in New England textile mills, according to Dean F. W. Shumard of the National School of Time Study, Norwalk, Conn.

During the month of August each year, according to this authority on labor costs, there is a period known as dog days when the humidity and temperature are so high that the sticky weather conditions prevent usual output. Unless plant departments are protected by modern air conditioning, this disturbing period of the year reduces the capacity of nearly all operators even though they expend more than their customary effort. This situation is sometimes met by introducing relaxation periods twice daily at which time all machinery is either stopped, or other operators inducted to carry on while the regular ones are regaining energy.

However, this practice is looked upon with disfavor by many manufacturers because of the contention that many workers will violate relaxation periods and thus cause further enervation, instead of restored energy available for performance following the daily recesses.

Under average weather conditions the performance of each worker can be accurately measured. The product of his skill—and many other items converted to effective effort—results in definite output from which costs are projected.

During dog days the usual normal costs are erratic because the customary effort expended has resulted in less than normal output. This anomaly can be met by establishing production data for each man based on past performance during favorable weather conditions and using these data as an index. Thus, under average conditions, an operator will produce his usual output per day, but during adverse weather conditions, that same amount of production would require more hours per day. The difference between these latter required hours and the normal hours per day is an excess cost which can be charged to suitable accounts and thereby protect the operators who work harder and produce less during bad weather periods.

The ideal working temperatures for average indoor operations should be from 65° to 70°, to fall within a proper rest factor range, states Dean Shumard. Also, the atmosphere should be reasonably free from injurious ingredients.

Air Conditioning in a Pharmaceutical Manufacturing Plant

By C. W. SWENSON†

MODERN methods demand that the quality and accuracy of products be maintained and that delays in production due to changing weather conditions be entirely eliminated. To do this close control of factory atmospheres is necessary all year round in some types of plants. In many lines this means keeping the humidity low during the summer months and adding moisture during the winter months. Winter conditioning is usually handled by the use of sprays introducing a controlled amount of water in the factory. Extracting moisture in the summer is more difficult, but it is possible to maintain low humidities and still not change the temperature of the conditioned air. In other words humidity can be controlled entirely independent of temperature. This is important because in some processes the temperature must be kept constant to prevent physical changes which might result in injury to the product.

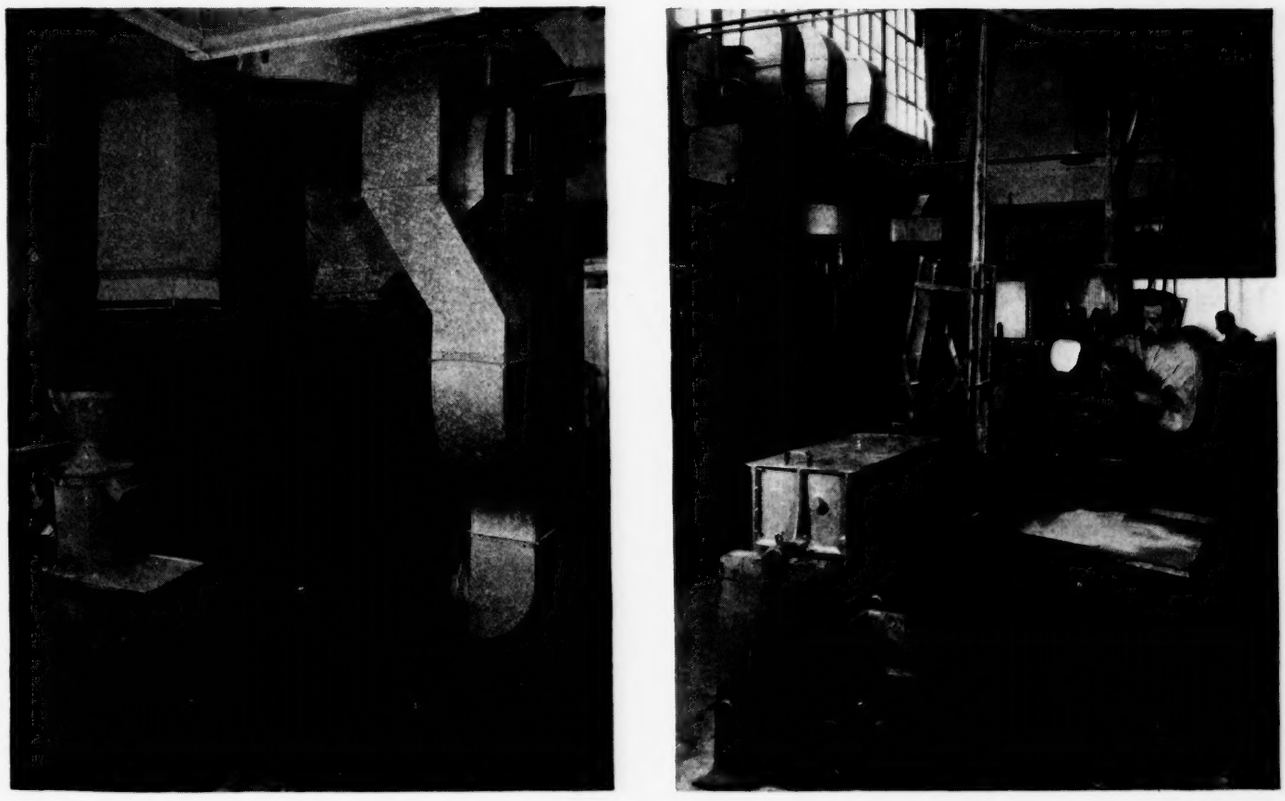
The silica gel system offers a practical and economical way of producing low humidity without materially changing the temperature. This method of dehumidifying consists of a series of silica gel beds with a fan to convey the adsorption and reactivation air through these beds, a gas fired heating unit for reactivation, a cooler and all of the necessary controls to make the system automatic. The process is continuous because of having two silica gel beds each connected with separate ducts and rotating dampers so that gas heated or activated air is alternately passed at predetermined intervals from one compartment to the other. The complete cycle is continuous as long as the unit is in operation and automatic because it is actuated by a humidistat located in the conditioned room.

The removal of moisture will vary with the temperature, rate of flow and concentration of vapor in the inlet air.

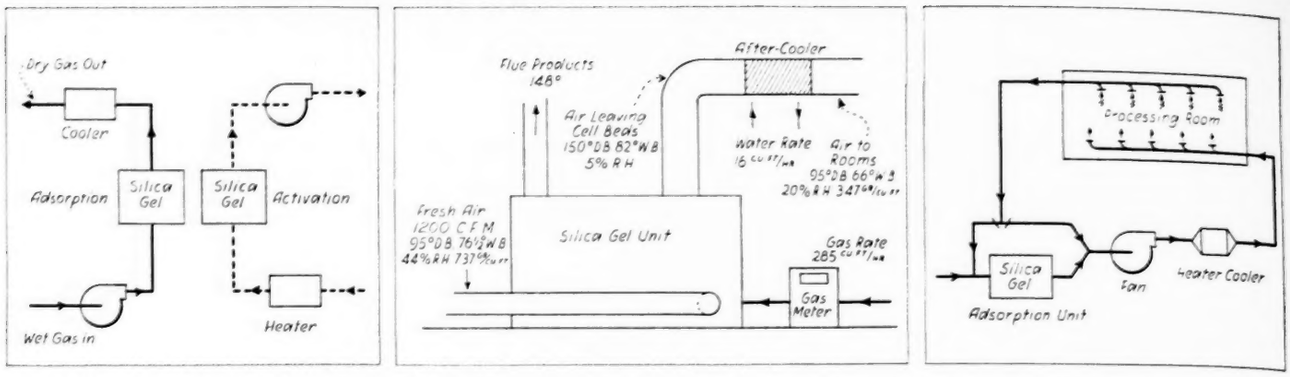
Plants making or handling hygroscopic materials such as paper, chemicals, silks, leather, pharmaceutical products and film have requirements which can be easily satisfied with this method of air conditioning.

In pharmaceutical laboratories, it is important that humidity be controlled and kept below 40%. One such plant is a large pharmaceutical one located in Man-

†Consolidated Gas Company of New York.



(Left) Silica gel unit for maintaining low humidities. (Right) Arrangement of unit and ducts in the pharmaceutical manufacturing plant



(Left) Two-bed, single-stage absorption scheme. (Center) Typical test results with a No. 10 silica-gel unit. (Right) A typical system for pressure conditioning.

hattan, with a silica gel air conditioner with aftercooler installed to condition the air in four rooms. The principal need for this air conditioning is in the tablet forming room, it being impossible to do this type of work when the relative humidity becomes excessive, especially so above 50%.

No air is recirculated due to the fact that the air is loaded to a considerable extent with powders. All air handled by unit as well as that needed for combustion and reactivation is brought in from outdoors.

The size of the installation can be judged from the following table:

MOISTURE LOAD

Room No.	Dimensions	Moisture Load	Material Moisture Equivalent
1	40 × 20 × 11 ft.	5 people	5 lb. per hr.
2	15 × 30 × 11 ft.	2 people	—
3	20 × 10 × 11 ft.	3 people	—
4	25 × 25 × 15 ft.	2 people	—

The total volume is 24,050 cu. ft. and the total moisture load is 123,500 gr. per hr.

All air to be conditioned is brought in from outdoors, the volume being 1,200 c.f.m. of air. This conditioned air is then delivered to each of the four rooms in proportion to the required load.

Tests were conducted on this installation and the following data show conditions existing on the test day:

Outside air—95° dry bulb; 76.5° wet bulb; 44% relative humidity, or 7.37 gr. per cu. ft.

Air leaving silica gel beds—150° dry bulb; 82° wet bulb; 5% relative humidity, or 3.15 gr. per cu. ft.

Leaving the aftercooler—95° dry bulb; 66° wet bulb; 20% relative humidity, or 3.47 gr. per cu. ft.

Air conditions in tablet room—92° dry bulb; 34% relative humidity.

Machine operates—83% of the time.

Gas consumption—285 cu. ft. per hr.

Water consumption—Average 4 g.p.m.

Electrical energy—1 hp.

Estimated operating cost (max.)—25 cents per hr.

Dimensions of unit—6 × 3.16 × 5.42 ft.

Dry air outlet size—13 × 13 in.

Wet air inlet size—12 in. diameter.

Keeping Swimmers Cool

PARALLELING the great amount of air conditioning work now under way, we find that cooling of water in swimming pools is being undertaken in many places.

The town of Tarboro, N. C., has installed a refrigerating machine for cooling the 60 ft. × 120 ft. swimming pool in its public playground. The water is held at a temperature averaging 80° in summer. A large fountain, with 12 spray nozzles, serves to cool the condensing water in turn.

The same principle is in evidence at the swimming pool of the magnificent St. Louis Country Club. This club, located in the beautiful La Due Village at the western edge of the city, has an 18-hole golf course, polo field, tennis courts surfaced with a special red clay brought in from California, and said to dry within five minutes after a rain, and a tile swimming pool measuring about 45 ft. × 110 ft. The water is cooled by being pumped through a multipass cooler, placed in an underground concrete chamber alongside the filters, chlorinator and "vacuum" cleaner which purifies the water. The entrance to this pit is obscured from the pool by suitable shrubbery. A 5 × 5 ammonia unit is connected to the cooler. Condensing water is supplied to the unit from an air washer through which a stream of air is kept circulating by a fan with a 2-hp. motor. The inlet and outlet for the circulating air are at opposite ends of the roof of the pit. An auxiliary condenser aids in carrying the ammonia load, using the comparatively warm water from the washer unit.

This club is furthermore distinctive in having all the fairways and greens on its golf course artificially watered from an underground irrigation system.—*The Frick System.*

Radiator Heat vs. the Warm Air Furnace

Advocates of former make a strong and savage attack on claims made for the furnace, indicating that a new Battle of the Basements is well under way

DURING war-time the furnace industry did itself no good by the mass production of pipeless furnaces, and the bad repute this gained the industry was aided by a large number of faulty installations of the pipe type. A remarkable recovery, however, was made during the decade following the war largely resulting from the effort and money spent by the industry in research work from which was derived basic data for the rating of furnaces and also the standard code for installation. In spite of the failure of many dealers to install according to this code, on the whole the industry found itself in fair shape by the time air conditioning began to be talked of for the home.

The essential difference between the warm air furnace and the radiator heating job—that the air is treated in the basement and delivered to the rooms in its desired form — made it possible for the furnace people to add blowers, filters, and washers to their systems quite easily. The result was heralded as air conditioning for the home and the warm air furnace rolled along on the popularity of the term air conditioning for a number of years; in fact, through most of the years of the depression.

This sudden popularity of the furnace apparently left the radiator heating industry in the position where they were, to put it mildly, considerably on the defensive. How could they, for instance, add humidity to the air? How could they filter the air? And what could they say about forced circulation and similar points which, according to the furnace people, were the fundamental requirements of an air conditioning job? Not only that, but how could they cool if the owner was so situated that he demanded this feature?

In attempting to solve these differences and to sell the public on air conditioning with radiator heat, a number of equipments have been developed in recent years. Unfortunately, however, the general public, due to the long campaign carried on by the warm air crowd, is not even yet aware of the advances which have been made in the line of winter air conditioning with radiator heat.

A number of guns have been fired in the campaign to educate the public along these lines. American Radiator, for instance, is putting more and more pressure behind its selling of summer and winter conditioning to the homeowner. In this they are aided by the publicity given to such year 'round and summer room units as are made by Frigidaire, Chrysler, Westinghouse, and General Electric, and which can be hooked up to or used in connection with a radiator heating system.

Recently a booklet appeared in Chicago under the authorship of C. G. Newton and H. R. Coleman, published by The Stevens-Root Company, manufacturer of a forced hot water heating system. The booklet is entitled "Radiator Heating and Air Conditioning Versus The Hot Air Furnace," and the authors have given the warm air furnace no quarter whatever. In doing this they analyze the arguments for the furnace and almost in the introduction of the booklet make an attack on "ill founded propaganda on humidity." Referring to statements made by furnace people regarding humidity, the authors say:

"Not contented to discuss the essential fundamentals, they (furnace men) have painted a rare and dazzling picture of the benefits to be derived from 'Humidity.' Ethical doctors have, in many instances, fallen in with their more blatant colleagues in endorsing this, as one might imagine, new benefactor of mankind. Architects have hummed the refrain of 'Humidity'—even editors have waxed eloquent in its praise. Suffice it to say, that the actual merits and limitations of artificial humidification have been so far overlooked by all of these ambassadors, that the average homeowner has, as a result of this tutelage, no more conception of what 'Humidity' really is than he had before. It has been presented to him exactly as would have been presented any new and neatly wrapped patent medicine, and as such he buys it.

"Suffice it also to say that the furnace man has not been backward in accepting this golden opportunity. In the past it was embarrassingly necessary for him to provide some means for supplying moisture to the dry carbonized air produced by his heater. Before the public became 'Humidity' conscious, these water pans, or wet plates, were considered more in the nature of nuisances than humidifiers. Now, however, thanks to his great army of unpaid publicity agents, the furnace man can point to this feature of his equipment as a voluntary contribution to human comfort, rather than an unfortunately necessary crutch. Of course, he has redesigned his product somewhat until instead of a mere moisture replacement unit he offers one capable of pouring a highly charged vapor into all parts of the house."

While on the subject of humidity, the authors refer to another fallacy of the furnace man, "one largely shared by the entire heating industry," and say:

"In the first place, it can be definitely stated that health does *not* require 45% relative humidity when the room temperature is 69.5°. There is no foundation in medical fact nor in human experience for such a generality. On the other hand, millions of people live in perfect health and safety in localities which enjoy an average natural relative humidity well below this figure. Some of the world's greatest health resorts appear in these localities. The specification of 45% relative humidity at 69.5° air temperature is merely a measure of effective temperature, and points out a desirable condition from the comfort standpoint. At a slightly higher temperature, the same effective temperature,—the same degree of comfort,—would result from a lower humidity. . . . There is no record of any house ever having been built which would permit the maintenance of 45% relative humidity at all times or make such a percentage advisable. There are numerous records of houses which have suffered excessive damage when this percentage was maintained. The condensation on windows in mild winter weather, on walls in more severe weather, and in unheated air spaces at all times, has caused this damage and will continue to cause it whenever 45% relative is maintaned constantly, in houses of standard construction equipped with windows and possessed of unheated air spaces. Insulation, double windows, weatherstripping, and other measures can reduce but not eliminate this possibility."

The next blow at the furnace man's sales arguments is on air movement. Here, again, the bulletin points out that the furnace man has turned an "inherent weakness" in his product to good account:

"The gravity air furnace was so woefully inadequate that the fan became a necessary though reluctantly added improvement. It was actually a confession of weakness at the time, and as such, and since it added to the cost

of a product which sold on price appeal primarily, was viewed with dubious enthusiasm by both buyer and seller. Shortly, however, the 'new industry' appeared upon the journalistic horizon, the furnace took new life and a new name, and its ill favored fan became the heart of an 'air conditioner.' Thus again, and easily, did the furnace live down its sorry reputation."

Having disposed of these two features which are really the heart of furnace selling features, the authors turn to air washing and air cleaning. They describe this by saying:

"The 'air washer,' of course, was designed to assume the double burden of absorbing dust and of humidifying. Obviously, then, it can function in the one respect only when and if it is required to function in the other. If no humidity is needed, no 'air washing' is possible. The filter as an air cleaner is not subject to this particular limitation; but both are dependent upon the operation of the fan. Since the fan operates only to deliver heat, there will be no cleaning in either case, and no humidifying incidentally, during the periods when no heat is required. The furnace industry has unanimously and enthusiastically avoided any mention of these practical and perhaps distressing details of operation, but has rather been content to have the prospective buyer believe that 'air motion,' 'air cleaning,' and 'humidification' are somehow miraculously accomplished from a single unit; each irrespective of the other and each in the degree required."

In some cases implied, and in others directly claimed, the feature of summer cooling has been brought up by the furnace man. Even if this was not included in a job, it has been pointed out that a cooling coil can be added to a furnace system and cooled air distributed through the ducts in summer. This is fallacious, according to the booklet, for the supply and return openings in the house when designed for heating are not in the correct position for cooling. Also, the duct system is too small for introducing correct quantities of cooled air into the rooms without discomfort. Destroying a last and final argument of the furnace salesman, that of the circulating of air in the summer by merely running the fan, it is pointed out that 15 to 30 air changes per hour would be required if the equipment were to qualify for this type of summer cooling, but the ducts are too small and in most cases of insufficient capacity to handle this volume of air.

Having called the attention of all those interested in radiator heating to the fallacies and weak points in the arguments for the warm air furnace, the authors call for a positive demonstration to the public that air conditioning can be accomplished with the radiator as a heating medium. There is a weakness, though, they say, in the radiator heating argument for "from the purely merchandising standpoint, it is obvious that the weakest link in the chain which must be used to raise radiator heating to its former level is the radiator itself. The buying public has no quarrel with the boiler, with steel pipe as a system for distribution, nor with any of the mechanical features of radiator heating. The furnace man has been able to make no sustained attack upon these features. It is the *radiator* which has been displaced—the *radiator* which affords the best target—and it is the *radiator* which must be vindicated in the eyes of the public. The radiator's greatest weaknesses are its most obvious characteristics. First among these is appearance and bulk. Next, perhaps, is its more or less past history for inconsistent performance which is, of course, more a fault of unsupervised application than otherwise. And last would be the fact of unsatisfactory operation, either because of improper design, installation, or use, or a combination of all three. On the other hand, the advantages of the radiator are not particularly apparent and are not, for lack of proper presentation, generally understood."

Having thus criticized the radiator, the writers suggest that the radiator must live up to its name and be a combination convector-radiator. It must be a convector in order to obtain circulation of the air in a room and it must be a radiator in order to warm distant objects and maintain a comfortable condition.

One point, however, is conceded the furnace: "It can be definitely stated, then, that the furnace man's claims concerning heating, air circulation, and humidification can be successfully disputed, and that valid counter claims in this regard can be made for the radiator. There remains one phase of winter conditioning which perhaps gives an advantage to the furnace, and that is in the matter of air cleaning. While the fan is in operation, a large percentage of the dust is removed from the air passing through the filter, and even though the fan does not operate all of the time there is undoubtedly some good accomplished in this respect. The control of radiator temperatures will help to reduce dust, since a large percentage of the dust in a house in winter is a result of drying out the fabrics, varnishes and paints which come in contact with dry overheated air. However, infiltration is also a source of dust, and it might be that some auxiliary means for air filtering would improve the picture for the radiator. This, though, is the only point at which the furnace can be said to excel from the standpoint of operation.

"The score then stands about as follows:

	Radiator	Furnace
Heating	1	0
Economy	1	0
Air motion	1	0
Humidity	1	0
Temperature control	1	0
Air cleaning	0	1
	5	1

"

Mechanical circulation of hot water is offered as a solution for better radiator heating. The authors conclude by pointing out that: "While the cost of an all radiator air conditioning system is an important factor, it is by no means the most important. Furnaces have always been sold, and probably will always be sold, to a large percentage of small homeowners. In the past, however, the furnace was sold only to those who felt that they could not afford the additional cost of a better system of heating. Furnaces are now invading the radiator market because the public has been led to believe that they are not only cheaper, but better. The problem of the radiator industry and of everyone who has an interest in it, is to convince the public that the radiator still offers the better system, and is still worth any reasonable additional cost."

H. G. Wells Prophesies on Air Conditioning

WITHIN another century air conditioning will have progressed to the point where every residence and office will be equipped for manufactured climate and artificial sunlight. This is the prediction of H. G. Wells, famous English novelist and historian, in his latest book, "Things To Come." It might be mentioned in passing that Mr. Wells has a high batting average in the percentage of his prognostications which have later become facts.

Describing a city of the year 2054, Mr. Wells presents the following conversation between two men:

Cabal—"It's fine outside—do you mind *coming out in the weather* with me?"

Passworthy—"Mind? I'm an open-air man. . . ."

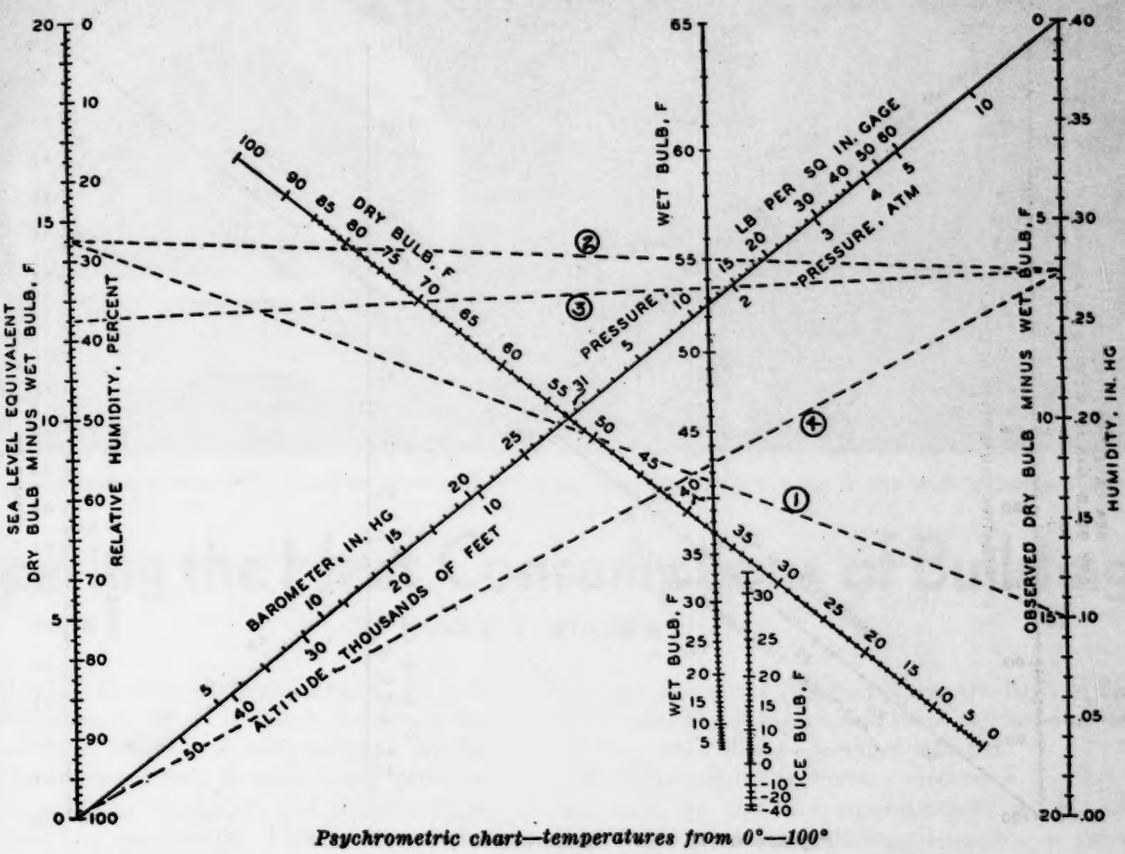
(They leave the subterranean city for the open air.)

Passworthy—"Here we are, up in the weather. Back to Nature. Well, well. Don't you feel better for it?"

Cabal—"If I did I should make trouble for our ventilation department! I'll confess I like the varying breezes and the shadows of the clouds—*now and then*."

PSYCHROMETRIC CHARTS FOR HIGH AND LOW PRESSURES

(From 1/8 to 10 Atmospheres)



Psychrometric chart—temperatures from 0°—100°

The usual psychrometric chart is drawn only for one barometric pressure, 29.92 in. Hg., and when used for pressures other than this gives incorrect results. The error involved depends on how much the actual pressure differs from the standard. The two charts which appear on these pages were developed for use in the determination of humidity from psychrometric observations at pressures ranging from ⅛ to 10 atmospheres. One of the charts is for temperatures from 0° to 100°, and the other from 32° to 212°.

The charts have been drawn from the psychrometric formula used by the United States Weather Bureau and while no actual experimental data are available for pressures above one atmosphere it is believed that since the formula has a rational basis they can be relied on for correct results for pressures up to 10 atmospheres nearly as well as at one atmosphere. They have been designed by Donald B. Brooks of the National Bureau of Standards, U. S. Department of Commerce.

In using the chart the first step is to convert the actual wet bulb depression as determined from psychrometers of suitable design to the sea level or standard atmospheric pressure reading. This is done by drawing a straight line from the value of the observed difference in temperature of the dry and wet bulbs (wet bulb depression) on the inner scale of the vertical line at the right of the chart through the diagonal pressure scale at the value of the total pressure and over to the line at the left of the chart. The value of the point of intersection of the drawn line with the outer scale of the left vertical line is the sea level equivalent wet bulb depression. If the readings of the wet bulb depression had been made at standard atmospheric pressure, 29.92 in. mercury, the values of the actual depression and the sea level depression would be the same.

The next step is to determine the humidity in inches of mercury. This is done by drawing a straight line from the sea level equivalent wet bulb depression through the observed wet bulb temperature on the center vertical scale over to the outer scale of the right vertical line.

(Concluded on other side)

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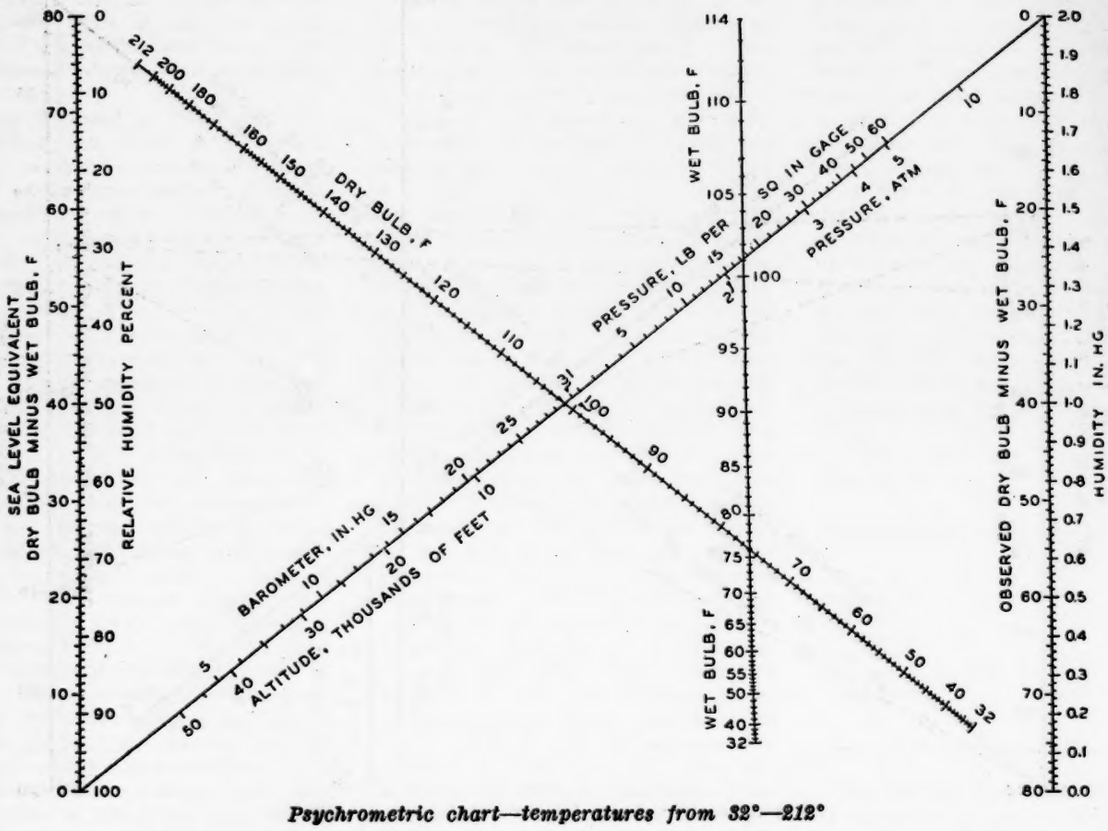
H. & V.'s REFERENCE DATA—65

PSYCHROMETRIC CHARTS FOR HIGH AND LOW PRESSURES

(From 1/8 to 10 Atmospheres)


SEA LEVEL EQUIVALENT DRY BULB MINUS WET BULB, F
RELATIVE HUMIDITY PERCENT
DRY BULB, F
WET BULB, F
PRESSURE, LB PER SQ IN GAGE
PRESSURE, ATM
BAROMETER, IN. HG
ALTITUDE, THOUSANDS OF FEET
WET BULB, F
OBSERVED DRY BULB MINUS WET BULB, F
HUMIDITY IN. HG

Psychrometric chart—temperatures from 32°—212°

(Concluded from other side)

From this point it is possible to determine the relative humidity and the dewpoint. The relative humidity is determined by drawing a line from the point determined above on the humidity scale through the observed dry bulb temperature on the diagonal scale over to the inner scale of the left vertical line. This point of intersection gives the relative humidity.

A line drawn from the humidity scale on the right vertical line to the 100% value on the relative humidity scale on the left vertical line will intersect the center vertical wet bulb line at the dewpoint.

Examples

Determining Water Vapor Pressure—Suppose a psychrometer reads 70° on the dry bulb and 55° on the wet bulb when the barometric pressure is 29 in. mercury. To find the pressure of the water vapor place a straight edge so that it intersects the Observed Dry Bulb Minus Wet Bulb scale at 70 — 55, or 15. Adjust it so that it intersects the Barometer scale at 29 in. and note the intersection with the Sea Level Equivalent Dry Bulb Minus Wet Bulb scale (14.5). Holding the straight edge at this point, swing it so that it intersects the (central, nearly vertical) Wet Bulb scale at 55°, and read the pressure of the water vapor (0.274) on the Humidity scale at the right.

Determining Relative Humidity—Continuing the example started above, hold the straight edge at the value 0.274 on the Humidity scale and swing it so that it intersects the (diagonal) Dry Bulb scale at 70°. By extending this line to the vertical Relative Humidity scale the relative humidity is found (37.6%).

Determining Dewpoint—Continuing with the data in the first example, connect 0.274 on the Humidity scale by straight edge with 100 on the Relative Humidity scale. The intersection of the straight edge with the Wet Bulb scale (42.8°) gives the dewpoint.

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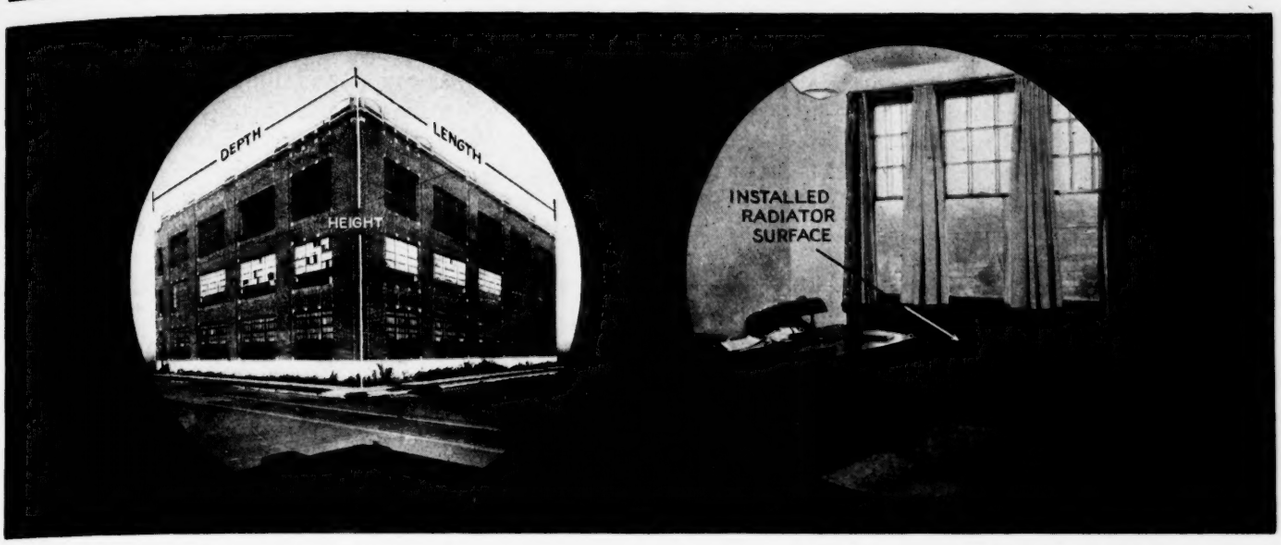

Heat consumption data are frequently based on two measurements—Gross Building Volume or Installed Radiator Surface.

Comparing the Heat Consumptions of Buildings

By HENRY T. KUCERA†

CONSIDERABLE agitation in the direction of heat control in buildings has stirred up much interest in the subject of building consumption comparisons. In the face of all this interest, there is surprisingly little information available on this subject and such information as is available is incomplete. This is undoubtedly due to the great many variables encountered in any attempt to make fair comparisons of heat consumption. Although the pounds of steam per degree-day is universally used as the unit of heat consumption, there is some divergence as to the temperature base used. The 65° basis is most frequently used. However, temperature bases used run from 55° to 70°. There are no less than six methods in use today as a basis of heat consumption comparison, each method having its advantages as well as its disadvantages. The six methods used are:

1. **Calculated heat loss from building**
2. **Total exposed surfaces of building**
3. **Installed radiator surface**
4. **Gross volume of building**
5. **Net volume of heated space**
6. **Net floor area**

Much work has been done of late to determine a suitable standard basis of comparison. However, due to the divergence of opinion in the industry, little headway has been made. The two methods most frequently used are the Installed Radiator Surface and the Gross Building Volume. The calculated heat loss method is without question the most accurate method of comparison, but due to the difficulty of calculating the heat loss of an existing building, it is seldom used. The other three methods are seldom used because of the difficulty of obtaining the necessary data or due to the excessive inaccuracies of the basis. Inaccuracies in the radiation basis are due to the fact that where the basis of figuring the radiation is not known, some buildings are over-radiated, while others are under-radiated.

The Gross Building Volume method is popular because it is the unit of comparison used in connection with building values, operating costs, etc., in the real estate and property management field. Although an equitable comparison of building values may be made on the basis of cubic contents, it is a poor method of comparing heat consumption due to the many variations in types of construction and the great difference in the ratio of exposed area to cubical contents. There is a considerable difference of opinion as to just what constitutes the cubic contents of a building, which difference adds further to the inaccuracies of the use of cubic contents as a basis of heat consumption comparisons of buildings. In some comparisons the building volume is taken as the volume enclosed by the outer surfaces of the outside walls and between the outer surface of the roof to one inch below the basement floor. This encompasses all closed courts, gables, and unheated attic spaces. In other instances courts, gables, and attic spaces are omitted from the building volume used.

Factors Affecting Heat Consumption Comparisons

In addition to the many variations of methods used, there are a great many factors affecting any heat consumption comparison that are seldom taken into consideration. Among these are:

1. **Per cent of building occupancy**
2. **Hours of heating**
3. **Maintained temperature**
4. **Basis upon which radiation was figured**
5. **Ratio of the average heating load to the capacity load**
6. **Climatic conditions**

Where radiators in unoccupied portions of a building

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are throttled or shut off entirely, there is a heat flow from adjacent heated rooms to the unoccupied rooms with the result that the heat consumption of adjacent rooms increases. In the average case, in the office or apartment type of building, the temperature of an unheated unoccupied space lies approximately midway between the building maintained temperature and the existing outdoor temperature. Thus the heat loss from unoccupied space is approximately half of that in the occupied space maintained at the higher temperature, and, although the radiators in the unoccupied rooms may be shut off, the load nevertheless exists, being carried by adjacent rooms. It is necessary in any true comparison of heat consumption, to compensate for variation of building tenancy. Fifty per cent of the volume or radiation load affected is a fair allowance for unheated unoccupied space. A building 70% occupied would, therefore, be carrying a heating load of 70% for the occupied space plus half load for the unoccupied space for a total heating load of 85%.

As the rate of heat loss from a building is directly proportional to the difference between outdoor and indoor temperature, the lower the indoor temperature, the lower the heat loss. For this reason, most buildings shut down the heating plant at night as early as the building tenancy permits in order to allow the indoor temperature to drop. The extent of the drop permissible is limited by the character of the building and by the capacity of the heating system to build up the temperature again in the morning. The lowest night temperature for the entire season in the average building is about 50°, with the night temperature for the entire season averaging 60°.

In climates where the average temperature for the heating season is 40°, there is an average of 30° temperature through which a building must be continually heated to maintain a constant temperature of 70° in the building. If it is desired to maintain an inside temperature of 60°, there is but 20° through which to heat, or a difference of 33 1/3% from that at 70°. Considered over a period of an hour, 33 1/3% represents 1.4%, or, for the sake of simplicity 1½% of the total daily load. Thus a building maintaining 70° for 12 hr. and operating at a throttled rate of heating during the night so as to maintain an average of 60° during the 12 night hours, will require 12 x 1½ or 18% less heat units than will the same building maintaining 70° for the 24-hr. period. Therefore, in comparing the heat consumption of two buildings having different hours of heating, a compensation of 1½% must be made for every hour of variance.

Where comparable buildings maintain different temperatures, allowance must be made in the comparison of their heat consumption. Although the theoretical increase in the rate of heat dissipation is roughly 100/70 of 1% per degree difference where a 70° temperature difference is used as a basis of radiation calculation, experience proves that there is actually 3% increase in the rate of heat dissipation per degree of maintained temperature difference where the lower maintained temperature is 70° or higher. This marked increase is due to a loss in efficiency of operation as well as to the opening of windows, etc., because of stuffy overheated rooms. Another factor affected by the higher maintained temperature is the variance in degree-days. Sixty-five degrees, the usual temperature basis used in calculating the degree-days, is predicated on a 70° maintained daytime temperature and an average of 60° night temperature. Where a day temperature higher than 70° is maintained, the temperature base should be adjusted accordingly. Should the 65° base be retained, the actual degree-days will be in excess of the calculated degree-days and, therefore, the load per calculated degree-day will be greater.

Allowances for variations of maintained temperatures in building heat consumption comparisons should be made at the rate of 3% per degree difference in maintained temperature.

In the design of the heating system of a building located in a climate comparable to Chicago, the radiation installed is based on an 80° temperature difference with a 15-mile wind. In milder climates, such as are encountered at Atlanta, radiation based on a 60° difference of temperature is sufficient. With comparable climatic conditions, every building has a definite heat loss per degree-day, no matter where the building is located. As a building in Chicago will have 8/6 as much radiation installed as an identical building in Atlanta, should we compare the steam consumption of the two buildings, using the consumption per degree-day per square foot of radiation basis, the Chicago building will show a lesser consumption per square foot per degree-day because it has more radiation installed than has the Atlanta building. Therefore, in order to form a fair comparison between any two buildings on the consumption per degree-day per square foot of radiation basis, it is necessary, where different bases for radiation calculation have been used to convert the basis upon which the radiation was figured to a standard base. The pounds of steam per square foot per degree-day consumption of a Chicago building should be multiplied by 8/6 in comparing it to the consumption of a building in Atlanta.

Where a heating system operates at a fractional load, there is always a loss in efficiency of operation. In milder climates, the extreme cold weather which may occur and which must be provided for, approaches that found in more severe climates, whereas the average day temperature is considerably above the average found in the severe climates. That is, the ratio of the extreme cold weather in milder climates to the cold weather in more severe climates is closer to unity than is the ratio of the average day temperature in the two climates. The period of time during which extreme conditions exist is far shorter in mild climates than is true of the more severe climates. All of this tends to decrease efficiencies of operation and increase the lag and standby losses in the milder climates, due to the fact that the heating system is caused to operate at a smaller per cent of load than is true in the more severe climates. This is particularly true in buildings having sluggish steam distribution systems. It is extremely

difficult to arrive at a true evaluation for this variation. However, a conservative increase in consumption of 4% for every 10° rise in the base at which the radiation is figured is generally acceptable. Where radiation is figured at plus 10° to 70°, an increase of 8% in steam consumption per square foot per degree-day may be anticipated over and above the steam that would be required in a climate where minus 10° to 70° is used as a basis. Thus, if the rate of steam consumption is 50 lb. per degree-day per 1000 sq. ft., in a minus 10° to 70° climate it will be 1.08 x 50 or 54 lb. per degree-day per 1000 sq. ft. in a plus 10° to 70° climate, all other conditions being equal or accounted for.

Variations of climatic conditions, such as sun, wind, and humidity, all affect the heat consumption of a building. In some locations, usually in the milder climates, these conditions are more favorable than in others. It is also true that in the milder climates the day temperatures are much higher in proportion to the night temperatures than is true in the colder climates. Thus, although the degree-days may be similar in the two climates, lesser heat units are required for heating a building in the milder climate than would be in a more severe climate because the outside temperature during the hours heating is required is higher. No attempt has ever been made to place an evaluation upon these factors. However, in any comparison of the heat consumption of buildings in radically differing climates, these factors should be given consideration.

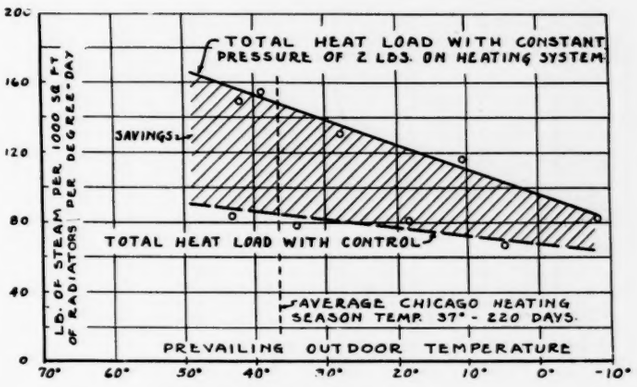
Evaluating a Control System

The comparison of the heat consumption of a building during two or more periods as before and after the installation of a heat control system is simply and accurately made by measuring the heat input over an extended time during each of the periods and using the degree-day as a basis of comparison. Many of the variables entering into any comparison of the heat consumption of several buildings do not enter into the comparison of the several periods of operation of a single building. Variations of load, occupancy, or hours of heating, if any, should be compensated for, however, in accordance with the plan outlined above for comparable buildings.

A true value of a heat control system may be obtained by comparing the heat consumption of a building with the heating system operating at its maximum rating to the heat consumption of the building with the heating system operating under control.

This evaluation of a heat control system is simple if approached in the proper manner. A perfectly operating control system will maintain an even temperature throughout a building with a steam consumption equal to the normal heat loss at existing conditions. The difference between this normal heat loss and the total heat input represents the possible savings.

When a building is not actively occupied during the entire 24-hr. period, economies are effected by: 1. Maintaining the desired temperature *only* during the hours the building is actively occupied. 2. Shutting the source of heat off as early as possible so as to permit the indoor temperature to reach the lower limit of the maintained temperature by the time the building is no longer actively occupied. 3. Keeping the supply of heat off as long as possible during the "off" period, without permitting the indoor temperature to drop to the freezing point or to below the point from which it may easily be built up again. 4. Turning on the full flow of heat in the morning at such time as will bring the building up to temperature at the time the building is again actively occupied.



A typical building load curve

Total season load without control:
220 × 137(65 — 37) = 843,880 lb. per 1000 sq. ft.
Total season load with control:
220 × 85(65 — 37) = 523,600 lb. per 1000 sq. ft.
savings: 320,280 lb. per 1000 sq. ft.
Per cent of savings = 320,280 ÷ 843,880 × 100 = 37.95%

By continually operating a heating system at its maximum rating, which would usually be 2 lb. steam pressure for the average steam system and 180° water temperature for the average water system, the maximum heat dissipation of a building is obtained. The difference between the heat units dissipated by the building operating at the maximum rating of the heating system, and the heat units required by the building under control represents the savings made.

Recording Heat Consumption

Many times, when it is desired to compare the heat consumption of buildings or the heat consumption of varying periods of heating of a single building, there are no available records of building operation upon which to base a comparison. Where such is the case and where it is impractical to make an extended test run, a fairly accurate basis may be established by metering the steam flow or fuel consumption over a period of as many days as is practical under a diversification of temperature conditions. Each day's operation is then plotted on a curve having the outdoor temperature for the average of the 24 hr. period as one axis of the curve and the pounds of steam or quantity of fuel per unit of contents or radiation per unit of time or per degree-day as the second axis. The plotted points are then connected with an averaging curve.

From this curve, the rate of consumption for the day having the average temperature of the heating season may be selected. This rate of consumption for the average day multiplied by the number of days in the

(Concluded on page 73)

Simplifying Modernization and Maintenance with Welding

OF the many lessons derived from modernization and maintenance, perhaps one of the most important is the increasing emphasis placed on welding. A case in point might be the installation of several dozen air conditioning room cabinets in the Chicago Tribune Building as a modernization theme. As the owners wished to avoid wall and floor cutting as much as possible, they asked for copper tubing for refrigeration and drainage lines.

Pipe joints were of the sweated type, soldering being effected not by the older, hand blow torch but by the newer process known as air-acetylene welding. Oxy-acetylene welding also was pressed into service throughout the job wherever rigid pipe was used. Thus, not only did the contractor, Kroeschell Engineering Co., Chicago, reduce surface damage to a minimum but also made a substantial saving in time, labor, and materials.

More in the nature of repair work was an outstanding 6-in. steam supply line replacement recently made in a large New York hotel. When a crack developed in one of the steam main's fittings, orders were given to replace 13 ft. of the main and two branch connections. The time was late in October and guests could not have their comfort interfered with more than was necessary. The old line was cut out with the welding torch at 9 a.m., a new 6-in. section with branches substituted by the same process and steam turned into the line again at 3 p.m. of the same day.

It is generally understood that air conditioning modernization has greatly increased the use of copper tubing. The red metal is used frequently for new heating risers and radiator laterals as well. The Marshall Field Annex modernization might be cited as an instance. Robert Gordon, Chicago contractor who handled the work, installed both condensate lines and many new risers with the aid of welding, the former being copper tubing with sweated joints made with the welding torch.

There's no institution that dislikes more to have its activities interrupted than a bank. So, when a large New Orleans bank recently ordered 40 new radiators and new risers and wished to prevent disfiguration of walls and floors, copper tubing figured prominently. It is worth noting that some copper risers were 3 in. Use of the welding process throughout considerably simplified the work.

Many modernizers of heating plants recommend replacement of cast iron boiler sections, when cracked, with new ones. If time and funds allow, this may be the best solution. On the other hand, if weather conditions do not permit dismantling the plant, bronze welding of section cracks shortens the time required for repairs. Many times, moreover, welding can be effected without dismantling the boiler, thus meaning that service is interrupted but a few hours.

So marked has been the development of torch welding of late that what has come to be known as air-acetylene, or low-temperature, welding now is more favored than soldering as done by the older method of hand blow torch and soldering iron. The newer process answers well for repair work as well as a more rapid method in modernization and maintenance contracts that call for the addition of new equipment.

Frequently old structures must be remodeled and otherwise improved to enhance their rentability and salability. A favorite theme at this time is to install new oil-fired, magazine and stokered boilers, or, again, new recessed radiators and replace old pipe lines with new ones. Practically all such improvements can be engineered quickly and satisfactorily with the aid of welding.

One instance that comes to the fore is that of a Buffalo, N. Y., heating and ventilating contractor who has been entirely successful in selling oil-fired boilers and renewed pipe lines. His prices usually are lower than his competitors', thus enabling him to receive preference. He explains that he can sell at prices under his competitors' because his costs are lowered by welding. He passes the saving on to his customers.

Naturally, one likes to fabricate as much of his piping as possible in his shop, transporting pieces to the location ready to erect. Yet, many times this cannot be done and it is necessary to make up special ducts, fittings and the like on the job. Without the aid of welding this might be impossible. Air-acetylene joints are more quickly made than those wherein the older, hand blow torch and soldering iron have to be used. Thus welding daily finds greater favor in virtually all divisions of ventilating duct fabrication.

Not long ago it was necessary to replace a large hot water storage tank due to its poor condition. Door and other entrances were too small to get in a new container of the desired size. The heating contractor made a new tank in the boiler room and set it in place. Without the oxy-acetylene torch this could not have been done.

Frequently fan motors, air conditioning pumps and their motors, hot water circulating pumps, and the like, have to be repaired on short notice. Armature repairs usually can be made with air-acetylene welding, while repairs demanding higher fusion temperatures can be made by switching to the oxy-acetylene method. Time, labor, and material saving have come to be characteristic of these processes, hence welding logically can be regarded as a modernization and maintenance short-cut of first caliber.

General Rules for Economical Heating†

By J. EARL SEITER‡

1. Weatherstrip all windows, and calk all window frames.

2. Provide revolving or vestibule doors on all entrances. Separate shipping and receiving rooms by partitions so that the ever-open large doors will not ventilate the entire building.

3. Keep the radiation near the outside walls, under the windows, if possible.

4. Eliminate all unnecessary ventilation. Ventilating equipment is sized to meet extreme requirements. Don't supply ventilation to a theater or auditorium adequate for an audience of two thousand when there are only two hundred present.

5. Determine the hours that heating is required during the day and see that the steam is shut off for the maximum time at night, on Sundays, and holidays.

6. Shut steam off entirely in unoccupied sections of the building, taking care to avoid freezing of plumbing.

7. Shut off steam during the day whenever possible. During the year steam can be shut off about 55% of the total daytime. The saving is proportional. An automatic control will do it perfectly, but it can be done by hand with amazingly good results.

8. Determine the temperature required for the occupancy of the building. Do not heat a storage garage or a furniture warehouse to the temperature required in a hospital ward.

9. Provide some good means of temperature control. No building can afford to be without such a control.

10. In a hot water heating system keep the temperature of the water down to correspond with existing outdoor temperatures.

11. In a vacuum system maintain a high vacuum. If this is not possible, locate and eliminate all leaks.

12. Install separate lines for those parts of the building that require long-hour or all-night heating. It is much cheaper than heating the entire building all night.

13. See that the entire system responds rapidly when steam is turned on. Locate and eliminate the cause of any sluggish circulation. Balance the radiation, provide adequate air elimination, and correct any trapped run-outs to provide quick system drainage.

14. Keep the system in good repair. Worn, damaged, or defective valves and traps will not function properly.

15. Cover all steam pipes.

16. Do not cover or otherwise obstruct the free circulation of air around the radiators; to do so seriously reduces the heating capacity of a radiator.

17. Use the heat in the condensate for hot water or some other useful purpose.

18. Provide thermometers and recording pressure gauges so that the engineer can operate the system with full knowledge of just what he is doing and what he is accomplishing.

19. Make all valves and controls convenient and accessible, either directly or through remote control. It is only human nature to delay and avoid doing that which is unnecessarily inconvenient.

20. Keep a consistent daily record, based on weather requirements, and watch it every day.

21. Know the system and understand its functions and its operation.

22. Control the heat supplied to water tanks located on or above the roof. Such tanks require heat to prevent freezing. No heat is required when the outdoor temperature is above 32°.

23. Investigate every complaint of "No Heat" by tenants. Find the cause and correct it. Do not overheat an entire building to correct a local condition in one room.

24. Never give up looking for ways to improve your distribution of steam, control temperatures, or methods of reducing heat loss.

25. Remember that benefits always come with modern and efficient methods of doing things.

†From a paper before the National Association of Building Owners and Managers.

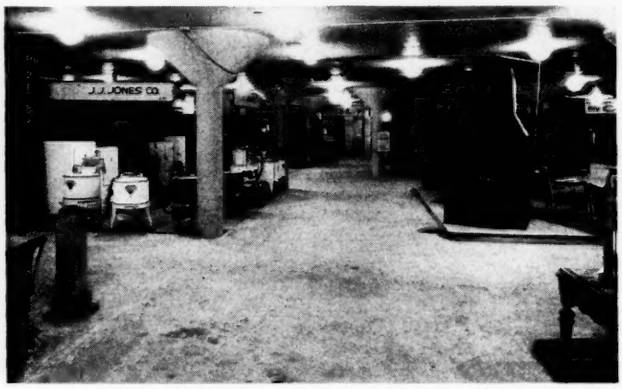
‡Assistant Manager, New Business Dept., Consolidated Gas, Electric Light & Power Co., Baltimore, Md.

Portland, Ore., National Housing Show

FHA's "Visual Demonstration" Program Develops Many Modernizing Prospects

THE Federal Housing Administration is going after the promotion of modernizing business in real earnest. Not satisfied with a widespread distribution of comprehensive printed pamphlets and the usual methods of country-wide publicity through the press, this Government agency is carrying its sales warfare right into the prospects' front-line trenches by means of a huge program of visual demonstration of what can be accomplished by "modernizing for profit" under the FHA financing plan.

Better housing shows, state and county fairs, and even model home demonstration centers are being utilized by the Administration as local points where exhibits, demonstrations, and explanations are being used to drive home to millions of modernizing prospects the story of what can be done to improve property and make it more profitable, through the use of the Government's insured loan plan, which provides funds for these purposes. If private industry had raised and spent millions in a joint effort to develop this type of business it couldn't have done as good a job as is now being done for it, without cost, by the FHA. The prospects developed for all kinds of remodelling work, involving not only building material and labor but many varieties of equipment, are just a "gift from the gods" for those in the manufacturing and building trades groups who are alive to the opportunity to cash in on this campaign.



1935 Home Show, held in Exposition Hall, Milwaukee (Wis.) Auditorium

And this FHA program is no piker's gesture, either. A glance at the figures below will show that this graphic presentation of the advantages of modernizing is being hammered home to millions of people all over the country, and that wide-awake concerns are actually closing business right on the spot at these shows and fairs. Here is a brief story (taken from FHA compilations) of what has happened to date:

BETTER HOUSING SHOWS
(September, 1934-October 1, 1935)

Number of major expositions held	57
Number of exhibitions at shows	646
Total attendance	4,911,693
Number of prospects secured by 554 exhibitors	147,264

Number of orders taken at shows by 400 exhibitors..7,736
Volume of business traceable directly to shows, reported by 400 exhibitors $1,667,878.00

BETTER HOUSING PROGRAMS AT STATE AND COUNTY FAIRS
(July 1-October 1, 1935)

Number of state and county fairs definitely lined up for featuring better housing exhibits.....764
Attendance at 111 of these fairs, already held....13,600,926
Number of inquiries for modernizing, repairs, etc., reported by only 18 booths at fairs.....9,182
Number of states and territories reported as active in organizing these fairs.....49
Rating of states most active in this work is as follows:

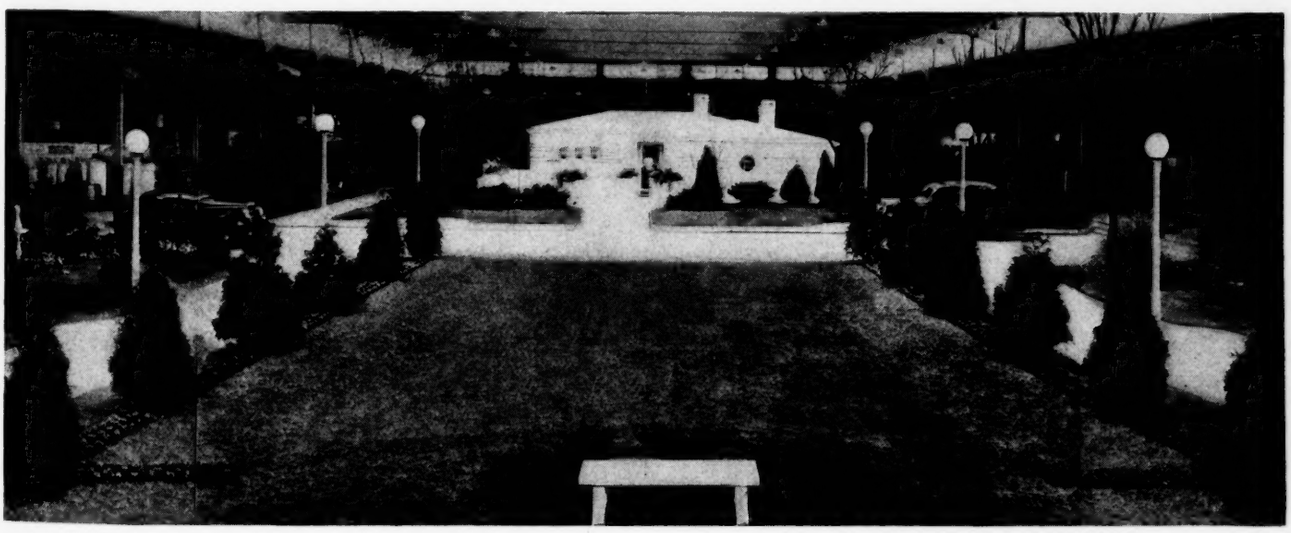
STATE	NO. OF FAIRS
Minnesota	92
Iowa	44
New York	42
Michigan	42
Tennessee	41
Texas	39
Virginia	37
Oklahoma	36
Maine	35
Nebraska	35
Ohio	29
Mississippi	24

In addition to the above there were 423 modernizing home demonstrations conducted at garden and flower shows, cooperating with the Better Housing Program.

A specific instance of one of these shows that may be cited to demonstrate just what is being accomplished, is that of the annual exhibition of the Electrical League of South Jersey held this year at Convention Hall, Camden, September 25-28. Some 15,000 persons attended this exhibition, and about 5,000 pieces of FHA modernization literature were distributed. Examples of some of the actual sales results in heating equipment that were developed at this show are as follows: W. C. Davis of Haddon Heights sold three oil burners right at his booth. The S-K Oil Burner Co., West Collingswood, reported seven oil burner sales. Incidentally, they stated that they were amazed at the number of people attending that did not know that oil burners could be purchased under the FHA Modernization Credit Plan. The Bornstein Electric Supply Company reported nine oil burner sales; the Hajoca Company, five oil burner sales, and other exhibitors reported nine additional oil burner, and one air conditioner, sales. All of the above were financed under FHA insured loans.

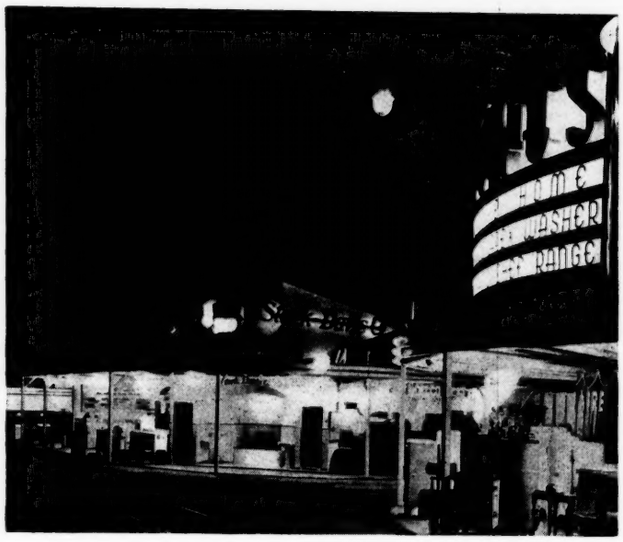
Some of the results obtained by exhibitors at the larger shows and fairs are impressive and indicative that under the new $50,000 amendment to the National Housing Act, permitting the purchase of equipment, the heating and air conditioning industry is in line for real sales activity as a result of the FHA program. Here are some of the result figures covering sales of this type of equipment: At the Omaha Building Show, the Bennett Company, selling oil burners, had more than 10,000 visitors at its booth. Out of these they developed 50 immediate business prospects. H. Grieb, selling oil burners, an exhibitor at the Central Queens' Better Homes Exposition, held in Jamaica, L. I., had approximately 20,000 visitors at his booth, while the Marshall Wells Company, who exhibited plumbing and heating equipment at the Fourth Annual Home Modernizing Exposition in Billings, Mont., developed 80 business prospects at the show, and closed sales aggregating $15,000. At the Builders Show in Minneapolis, Waterman-Waterbury, handling heating and air conditioning equipment, closed $5,000 in sales at the show, and sold another $5,000 worth of equipment during the 30 days following to prospects developed during the exhibit. Perhaps the most outstanding record yet received at the Housing Administration headquarters is that made by Sears, Roebuck & Company at the Milwaukee Home Show, where it sold some $12,100 worth of equipment and material at the show, and closed over $50,000 additional business resulting from the show during the following 30 days. These figures cover only the heating and ventilating business done by Sears at this show.

These are not isolated examples of the business that has been and may be developed by live sales depart-



"Personality House," exhibited at the home Show, Indiana State Fair Grounds, Indianapolis

ments in the building field, who make a real effort to cash in on the prospects that FHA is developing in the modernizing field. On the contrary, they represent a fair cross-section of the experience of exhibitors who have been active in following up these demonstration projects.



View of exhibits, Na'ional Housing Show, Portland, Ore.

While the $50,000 amendment has not been in operation long enough to determine final trends, it is interesting to note what is happening so far, as indicated by a careful analysis made by FHA of some hundreds of loans that have been insured to date. For instance: Modernization of industrial and manufacturing plants, and the installation of equipment and machinery account for approximately 33% of the insured FHA loans, made under the new amendment limit. A further breakdown shows that store remodelling loans in this class are first in number of loans, with factory and industrial plant loans in second place. Loans to operators and owners of industrial properties average largest, being $9,770, as compared with $5,581 for all purposes eligible under the amendment. Taking structural improvements alone, as a means of comparison, industrial loans were double the grand average, amounting to $11,415, with expenditures entirely for equipment and machinery amounting to $5,574. Borrowing for equipment and machinery installations amounted to 33% of the number of loans and 23% of the total credit advanced. Structural improvements accounted for 66% of the loans in point of numbers, and 77% in money volume.

The Federal Housing Administration commenced, recently, the compilation of "case" histories of loans made under the new amendment. An examination of these records impresses one with the fact that the equipment provided by the heating and air conditioning industry goes into nearly every one of the modernizing projects detailed. For example, the description of a service station remodelling job done for Gottfried Hockanson, Chicago, with an insured loan under the amendment, carries the statement that the remodelled building was provided with a modern steam heating plant. Again the case history of an FHA insured loan made to the Everhot Manufacturing Co., Maywood, Ill., which involved the remodelling of enlarged factory quarters acquired by it, states that "automatic control of heat will keep the building at an even temperature, while a gas blower will condition the offices when the factory is not in operation," and similar statements are carried in many others of these case records.

Perhaps one of the most startling ideas developed in the FHA's case records is that one remodelling operation may be the generating force that sets in motion a whole line of other expenditures. A case in point is that of the remodelling job, financed in part by an insured loan under the new amendment, done by the Miller & Dobrin Furniture Co., Passaic, N. J. This concern was in need of larger quarters. They purchased an old, rundown building and completely modernized it, including, incidentally the installation of a central heating plant with the newest type of oil burner. This operation so changed the aspect of the immediate neighborhood that, according to the FHA report, a grocery store across the street that had been rented, formerly, with difficulty at $20 per month, was soon let to a chain grocery for $100 per month. A store room next to the newly modernized structure of Miller and Dobrin had been vacant for nearly a year, although offered at $25 a month by the owner. Sensing that the neighborhood was "on the make" the owner of this store modernized it, and installed a live business concern in it.

Furthermore, Miller & Dobrin, under the new setup, will increase its working staff from 12 to 45 employes. They anticipate an increase in business, under the new conditions, of approximately 150%, which has necessitated the immediate addition of $50,000 worth of new merchandise to its stock, all of which means, of course, that stagnant business is being stimulated in many directions from the focal point of one modernizing loan.

During the week ending October 19 there were 19,832 loans reported under the modernization credit plan, totaling $6.5 million, bringing the total loans reported since the beginning of the modernization program in August, 1934, to 499,169, amounting to $185 million.

Financial institutions reported 1,497 mortgages selected for appraisal totaling $5.9 million during the same week. The cumulative total since the beginning of the mortgage program last December is 51,541, valued at $200 million.

That the Federal Housing Administration's drive for modernizing business is producing actual results, is beyond question. And there is no indication that there is to be any letup in this "push" to put the building and equipment industries on the map. How much good this tremendous sales promotion program is actually going to do these needy groups pretty much depends, it would seem, on how active these industries are in taking advantage of the modernizing interest being created in the minds of millions of prospective buyers.

Electric Utility Holding Company Issues Report on Air Conditioning

SOMEWHAT more than a year ago a report on air conditioning was made for its operating companies by Electric Bond and Share Co., New York. An abstract of the material in this report appeared on these pages.[1] A report on the same subject designated as the "1934-1935 Report" has been published by the same company and recently issued.[2] According to the authors, the air conditioning picture in the last year and a half has not changed in any essential element, except as to the position attained by the more important equipment manufacturers who have developed their products and their selling organizations to a point now giving promise of large-volume sales in the near future. The authors also feel that the education of the public regarding the advantages obtained through air conditioning has made substantial progress.

Some of the comments of the authors regarding application of air conditioning to specific types of buildings are of interest, since they summarize the situation as observed by those well informed on the subject of air conditioning, but not closely connected with the industry. Abstracts from these comments follow:

Residences and Apartment Houses—New residences constructed with partial or complete air conditioning, during the past year, almost without exception have central plant duct systems. These are quite similar to mechanical circulation warm air heating systems that a few years ago superseded gravity warm air types for all but the cheapest dwellings. Modifications incorporated for air conditioning comprise addition of filters and humidifiers, greater attention to position of room inlet grilles, and provision of automatic control for temperature and humidity. Cooling and dehumidification are generally accomplished by means of extended surface coils mounted in suitable housings adjacent to the furnace; depending on local requirements, the cooling medium used may be city water, direct expansion refrigerant, or recirculated water cooled by a motor driven condensing unit or an ice bunker. In localities where gas is available, dehumidification may be made a separate and independently controlled function, using refrigeration only for removal of sensible heat.

Air conditioning of apartment houses has not yet reached the point where it can be said to have attained public acceptance. Very few new apartment houses have been built since 1932, and with prevailing low rents and high taxes, there is virtually no incentive to encourage activities in this field. Opinion is that when construction projects start up, the systems selected will in nearly all cases be of the unit type. These may utilize (a) self-contained room conditioners placed under windows or in adjoining closets, or (b) room cooling and heating units, similarly located, using metered chilled water from a central refrigeration plant operated by the building management, or direct expansion refrigerant from condensing units located in a special closet provided for the purpose in each apartment. Building wiring would then be laid out to provide feeders for air conditioning motors in the grouped closets, independent of apartment wiring system for lighting and appliances, to prevent annoying voltage disturbance when good size compressor motors are controlled automatically by across-the-line starting methods. Steam or forced circulation hot water would be supplied to heating coils in unit conditioners, from private boiler plant or district heating mains—the same as in non-conditioned buildings.

For *existing* residences and apartment houses, equipped with direct radiation heating systems, unit conditioners are almost universally used. Only under exceptionally favorable structural limitations, or when thoroughgoing renovations are undertaken, is it economically feasible to install ducts permitting use of central plant systems.

Barber shops are a fertile market for air conditioning.

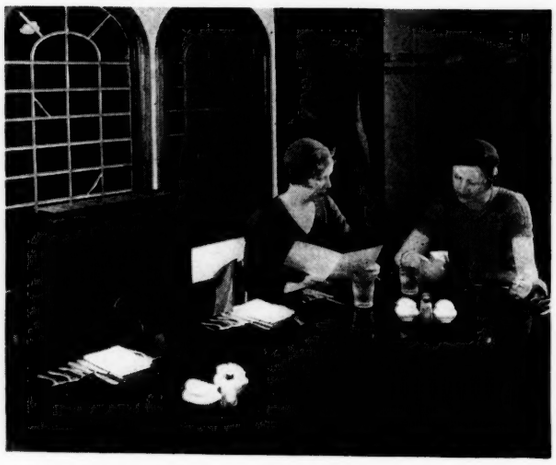
Installation of air conditioning equipment in an occupied residence or apartment calls for carefully planned procedure and specially trained mechanics, if the work is to be executed without undue annoyance of tenants or owners. Equipment dealers and contractors most successful in this field have found it desirable to recruit mechanics of the skillful handyman type, training them to perform the operations ordinarily distributed between carpenters, pipe fitters, sheet metal workers, electricians, and painters—where the trade union situation permits. Practices followed by interior decorators, piano movers, etc., capable of

[1] HEATING & VENTILATING, July, 1934, page 23.

[2] A standard size, 225-page planographed book prepared by W. F. Friend, assistant mechanical engineer, and Louis Elliott, consulting mechanical engineer, both of the engineering department of Electric Bond and Share Company. The publication is privately issued and copies unfortunately are not available to the public.

doing their work neatly and expeditiously, leaving no traces behind when the job is finished, may to a considerable extent be adopted by air conditioning equipment installers.

While in the aggregate a large number of residential and apartment house installations have been made throughout the country during the past year, they are practically all of unit type in the smaller sizes (under five tons total refrigeration capacity) and few detailed descriptions have been published. Problems encountered, calling for a good deal of ingenuity to reach a practical and economical solution satisfactory to the customer, are of limited general applicability.



Restaurants and tea rooms have found a large profit in air conditioning.

Hotels—Commenting on a hotel installation in Detroit completed in June, 1934, the authors say:

The hotel management is still acquiring experience with bedroom units. It has been found that all guests do not desire comfort cooling. While on the whole, air conditioning has been highly satisfactory, a few individuals not accustomed to sleeping in air conditioned spaces express disapproval of the innovation and tend to complain that rooms are "stuffy." In a few instances, the temperature differential between corridors and cooled rooms is considered unpleasant. However, two out of three guests when leaving say they like the system, or are definitely enthusiastic; reasons given are quietness, cleanliness, ability to sleep well in hot weather, benefits for hay fever, or plain "comfort."

Windowless Department Stores—Writing about the Sears, Roebuck department store in Chicago, completed in 1934, which is completely air conditioned and without windows, the authors report that the advantages expected to accrue from the principles incorporated are: 1—Simplification of air conditioning problem; 2—savings from elimination of merchandise deterioration caused by infiltration through windows; 3—reduction in losses from sun effect on exposed merchandise; 4—exclusion of street noises and other disturbances; 5—addition of 6,000 sq. ft. floor space, because interior arrangement no longer depended on window locations; 6—greatly improved store arrangement; 7—reduction in cost of heating and cooling equipment; 8—improved quality of lighting, because inharmonious effects caused by simultaneous artificial lighting and daylight were eliminated.

Industrial Plants—A department of the Crosley Radio Corporation devoted to assembly of refrigeration compressors in the smaller sizes was air conditioned this year. Object sought was prevention of damage from foreign particles, dust, and moisture getting on highly finished parts. The system was designed for one air change every 6 min., with room maintained at slight positive pressure to prevent entry of dirt or moisture through doors, windows, and leakage crevices. The expense involved was felt justified because of extremely close tolerances established for machined parts, and the high character of work demanded.

The main foundry of Ford Motor Company is now being equipped with air conditioning. While close temperature control is impossible, owing to heat from ladles of molten steel while casting is in progress, a substantial reduction of temperature and humidity is readily obtainable for improvement of working conditions. Dust removal is also of much benefit; air washing apparatus previously used in the foundry collected about 42 tons of dirt weekly. Other air conditioned departments at the Ford plant include cylinder-barrel finishing, gage rooms, and a number of inspection rooms. Apparatus employing air conditioning principles is now coming into use in lacquer departments for protection of workmen against poisoning, with a secondary benefit from recovery of droplets floating in the air; a skimming arrangement in the spray water collecting basin yields a considerable amount of useful lacquer.

Some data prepared by Messrs. Derry and Zboyosky of the Pennsylvania Power and Light Company on the cooling load in textile plants are also reported. These data are in the table below.

Installations are of central fan type in all cases; for throwing plants, supplementary atomizing heads are located above conditioned air outlets, permitting smaller air change and reducing size of air handling equipment; compressors for supplying atomizing air constitute an appreciable part of total connected load.

Unit figures and ratios shown in tabulations should be used with caution, since they are subject to considerable variation in different plants, depending principally on location of departments served, character of building construction, and amount of motor load for manufacturing in relation to floor area. In some in-

Material	Silk Throwing	Rayon Throwing	Silk Weaving	Silk Weaving
Process				
Humidity maintained, %	70	55-60	65	70
Summer temperature above outdoor wet. bulb, °F.	14	19	—	—
Floor area served, sq. ft.	26,400	36,000	53,100	26,000
Installed cost	$15,000	$19,000	$16,000	$15,200
Cost per sq. ft. floor area	$0.58	$0.53	$0.30	$0.58
Total connected hp.	57	125	35	40
Power requirement kw/1000 sq. ft.	2.18	2.16	0.49	1.14
Demand, kw/connected hp.	1.00	0.62	0.75	0.74

stances, individual factors may compensate for each other; for example, in throwing plants, motor load may be three to five times that in weaving plants, and location on shady-side intermediate floor may void heat conduction through roof or large exposed window area.

Installation Statistics

The authors have tabulated data on the number of installations, connected load, tons of refrigeration, and annual sales of electrical energy by 15 operating subsidiaries of the Electric Bond and Share Company. These companies[3] had a total number of installations of 2,511 made prior to 1934. These had a connected load of 22,786 hp., serving 11,025 tons of refrigeration. The same companies during 1934 reported 363 installations with a connected load of 3,996 hp., and 2,921 tons of refrigeration.

These figures refer to partial or complete air conditioning. In addition, these 15 companies reported on what the authors designated as "miscellaneous appliances related to air conditioning, but not considered as being for complete or partial conditioning." For the reporting companies these are:

Equipment	Prior to 1934		During 1934	
	No.	Hp.	No.	Hp.
Attic fans	47	22	176	52
Window filters	25	3⅜	14	2½
Electric humidifiers	25	2½	22	3¼
Oil burners	1695	403	502	126
Domestic stokers	1106	418	462	134
Furnace blowers	804	179	404	124

Supplementary data in addition to the tabulated material and not included in the previous figures were obtained from several additional utilities as follows:

Mississippi Power and Light Company reported 34 installations totalling 136.3 hp. and 105.6 tons on its lines up to August 15, 1935. These are all residential and commercial installations, the majority being commercial jobs. No industrial air conditioning customers are served by this utility.

Nebraska Power Company—This utility reports 38 comfort cooling installations with refrigeration totalling 344 hp. on its lines up to the first of January, 1935. In addition, there are on the lines the following miscellaneous appliances:

Equipment	No.	Hp.
Furnace fans	340	85
Attic fans	60	12
Oil burners	430	108
Exhaust fans (commercial)	60	15
Miscellaneous washers, etc.	20	10

Pacific Power & Light Company—This company reports a connected load in 1934 as follows:

Equipment	No.	Hp.
Stokers	79	31.2
Oil burners	82	18.7
Fans	59	36.9
Unit coolers	25	32.9
Total	245	119.7

Popularization of Air Conditioning

Abstracts from the publication relating to the opinion of the authors regarding the increasing popularization of conditioning follow. These are excerpts, in most cases, as the authors have gone into considerably more detail than is advisable to reproduce here.

Theaters—In theaters, which represent the oldest and most highly developed application of commercial air conditioning, its adoption has become almost universal. Public acceptance and demand have been so general, and experience of managers and owners so favorable (as to effect on box office receipts), that according to one consulting engineer, no theater or motion picture house seating over 300 to 400 persons will in the future be constructed without all-year air conditioning. This statement was not however intended to apply to certain northern and northwestern regions having exceptionally pleasant climate.

Churches—Churches also represent a potential market, as yet hardly touched. A few well-to-do parishes have made installations, but until substantial economic and social changes take place, opportunities for equipment sales in this field are likely to be limited.

Public Buildings—Public buildings, including auditoriums, court rooms, legislative chambers, etc., constructed with work relief funds recently made available, are in many instances being provided with air conditioning.

Schools—Colleges and schools are in the same category as churches and small theaters—unable to avail themselves of air conditioning, owing to lack of funds. Educators are calling attention to the possibility existing of shortening the overall time devoted to education or of extending the curriculum, through elimination of long summer vacations. If school buildings were made comfortable for summer occupancy, overcoming inattention, lassitude, and rapid fatigue that accompany high temperatures and humidities, vacations could be shortened to perhaps two weeks and work now requiring five years might be accomplished in four.

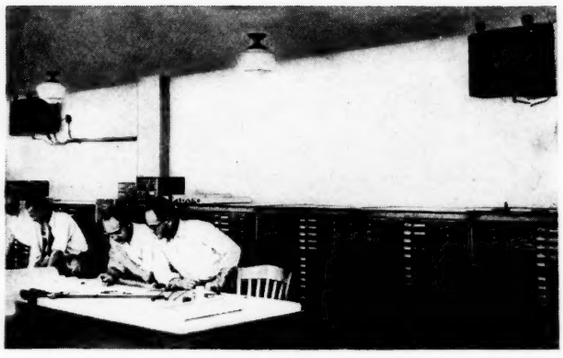
Federal Buildings—Summarizing the government building installations in Washington during 1934 and 1935 the authors present the following table:

	Tons	Cost Approx.
Archives Building	1,000	$370,000
Department of Agriculture	—	—
Department of Interior	950	1,000,000
Department of Justice	1,950	800,000
Department of Labor	—	—
Federal Warehouse	280	115,000
Interstate Commerce Commission Building	—	—
Library of Congress Annex	—	1,000,000
Library of Congress addition	55	—
Post Office building	1,460	500,000
Senate Office building (new)	330	152,000
Supreme Court Building	—	—
Treasury Department	375	315,000
Treasury Department (4th floor)	300	85,000
White House—Executive offices	130	75,000

[3]Which are: Arkansas Power & Light Co., Birmingham Electric Co., Central Arizona Light & Power Co., Dallas Power & Light Co., Florida Power & Light Co., Houston Lighting & Power Co., Idaho Power Co., Kansas Gas & Electric Co., Nebraska Power Co., New Orleans Public Service Co., Northwestern Electric Co., Portland Gas & Coke Co., Texas Electrical Service Co., Texas Power & Light Co., and The Washington Water Power Co.

Railroad Cars—Summarizing the information available on the number of air conditioned railroad cars in service or on order as of April 1, 1935, for those lines having 100 or more conditioned cars, the authors include the table below.

In addition to the lines listed in this table there are 21 railroads having between 10 and 100 cars and 10 with less than 10 cars.



Cooling equipment considerably increases the output of drafting and designing rooms.

	In Operation Jan. 1, 1935	Ordered After Jan. 1, 1935	Total
Santa Fe	59	280	339
Baltimore & Ohio	121	87	208
Chicago, Milwaukee & St. Paul	22	149	171
Chicago & Northwestern	22	189	211
Missouri Pacific	38	89	127
New York Central	84	235	319
Pennsylvania	276	78	354
Pullman Co.	1,406	—	1,406
Southern Pacific	32	260	292
Union Pacific	56	45	101
Total	2,116	1,412	3,528

Automobiles — Several accessory manufacturers are experimenting with air conditioning (cooling) equipment for private passenger cars. One of these uses a water tank supplying an evaporating cooling device; another employs a small condensing unit driven by power take-off from transmission gears, with evaporator coil under driver's seat. It is believed that a considerable market could be developed for portable ice-using equipment in southern and western states; the arrangement might be designed for placing in rear luggage compartment or on trunk rack. Manufacturers should be encouraged to work out something of this sort, as helping to provide a market for excess ice-plant capacity.

Airplanes — Material constituting a basis for consideration of air conditioning of airplanes was included in a recent paper presented before the Institute of the Aeronautical Science by E. R. Bassett, chief engineer, Sperry Gyroscope Company. Analysis of the influences affecting a passenger, that should be considered in overall design of transport planes, include: change of angle of attitude of the carrier, and accelerations of the carrier; noise level; vibration; amount of ventilation, affecting odor; heat and cold; atmospheric pressure and rate of pressure change. The composite effect should be controlled so that it will be below the "psychological boundary," defined by Mr. Bassett in the following statement: "The boundary between comfort and discomfort may be termed 'the psychological boundary,' since the discomfort is largely in the mind and very little of it is actually physical. As the magnitude increases, however, the physical discomfort increases in proportion until, when we reach the second boundary between discomfort and the unbearable, this may be termed 'the physiological boundary,' beyond which the human body cannot function continuously."

Among the influences that are important in conditioning of rooms are noise, supply of air, heating, and odors. Mr. Bassett states that with respect to noise the comfort level lies under 85 decibels, the discomfort range from 85 to 120, and the unbearable zone above 120. He says that an airplane passenger should have an especially generous supply of air—a minimum of 30 c.f.m. Temperature should also be more closely controlled than is usual—within two degrees of 71°. All traces of odor should be eliminated.

Dust Storms and Health

A RECENT report of the U. S. Public Health Service recalls the dust storms of early 1935 in the middle west. The report is entitled "Dust Storms and Their Possible Effect on Health," and the authors on analyzing samples of the dust taken from various localities in the path of the storm found that "no evidence has been found that any pathogenic organisms were carried by the dust, and therefore the direct cause of the increase in respiratory infections could not be attributed to this factor. The dust, however, was exceedingly irritating to the mucous membranes of the respiratory tract, and in our opinion was a definite contributory factor in the development of untold numbers of acute infections and materially increased the number of deaths from pneumonia and other complications."

At the time of the storm it was reported that air conditioning dealers in Kansas City and other midwestern cities had a number of air conditioning equipment sales resulting from the storm. Undoubtedly those buildings equipped with air conditioning systems which could filter the air were faced with but little damage from the dust, while the losses in buildings not so equipped ran into large sums. Reports indicate that air conditioning was uniformly successful in maintaining desirable indoor conditions in that territory regardless of the intensity of the dust content and the wind velocity outdoors.

Engineering Gas Conversion Burner Installations

3—Estimating Gas Consumption and Sizing Flue Pipe

By ALFORD G. CANAR†

IN order to select a burner of sufficient gas capacity for any particular boiler or furnace, it is necessary to determine, at least approximately, what the required hourly gas consumption must be to handle the job.

The hourly heat loss over the range of design temperatures (0° to 70° in Chicago) is the basis of this calculation, and gives a close approximation in fully 90% of the cases.

The formula used is as follows:

$$\frac{\text{Hourly Heat Loss (B.t.u.)} \times \text{Selection Factor}}{\text{B.t.u. of Gas} \times \text{Operating Efficiency}} = \text{Cubic Feet of Gas per Hour}$$

In the early days of our experience with conversion jobs we assumed that a selection factor of 1.60 was necessary in order to make sufficient allowance (60%) for standby losses, radiation losses, and pickup. Experience has shown after a study of a large number of cases that a selection factor of 1.40 is sufficient for practically all boiler jobs and that 1.35 was sufficient for furnace jobs under 60,000 B.t.u. hourly heat loss, and a factor of 1.25 was sufficient for furnace jobs over 60,000 B.t.u. hourly heat loss.

The operating efficiency of a good conversion burner installation is considered to be about 70%. However, some will give a greater efficiency and many will give less. When the efficiency factor is assumed to be 70%, the formula will give a close approximation for all but a small number of cases.

Substituting in the equation a selection factor of 1.40, 800 B.t.u. per cu. ft. for the calorific value of the gas in Chicago and an efficiency factor of 70%, we obtain for a boiler job a factor of 2.50 which, when multiplied by the thousands of B.t.u. heat loss, will give approximate required hourly gas consumption.

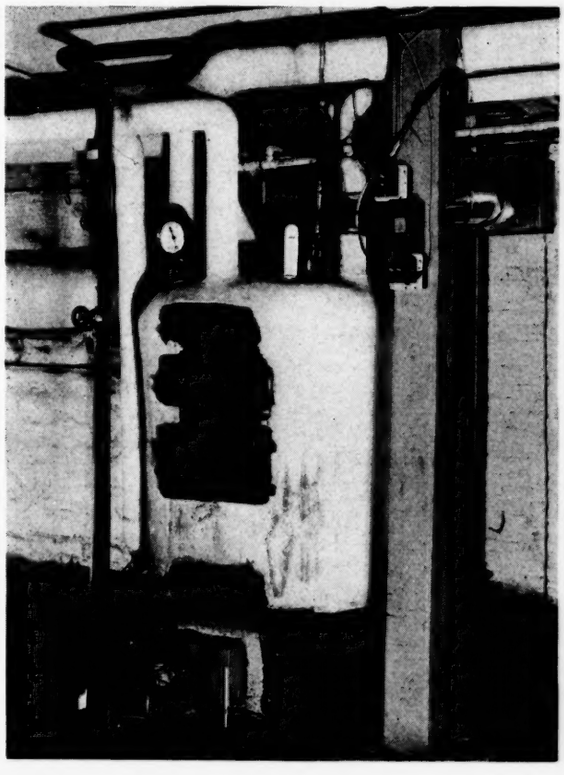
$$\text{Cubic Feet of Gas per Hour} = \frac{\text{Hourly Heat Loss} \times 1.4}{800 \times 0.70}$$
$$= \text{Hourly Heat Loss} \times 0.0025$$
$$= \text{Thousands of B.t.u. Hourly Heat Loss} \times 2.50$$

Thus, the thousands of hourly heat loss needs only to be multiplied by the factor of 2.50 to calculate the cubic feet of gas per hour.[1]

In a similar manner, for furnaces, the factors of 2.40 for jobs under 60,000 B.t.u. hourly heat loss and 2.20 for jobs over 60,000 B.t.u. hourly heat loss are calculated.[1]

Calculation of required gas consumptions based on the ratings of boilers and furnaces has been thoroughly investigated and checked but has been found to give gas consumptions of from 10 to 40% high. Furthermore, so many old boilers and furnaces and still older obsolete types are encountered where no rating data can be obtained that this method is considered to be too impractical.

Calculation of hourly required gas consumptions based on standing radiator and actual amount of warm air leader pipe area was also found to be impractical because of great variation and inconsistency in results.



Sizing the Flue Pipe

The next important preinstallation feature of engineering to be considered is sizing the flue pipe, based on the probable gas consumption which the particular job requires. It is very essential to size the flue since the flue sizes generally found with solid and liquid fuel firing are too large when the job is converted to gas firing and too strong a draft would result.

When firing a boiler with solid fuel a certain draft intensity is necessary not only to vent to the chimney the large volume of products of combustion, but also to pro-

†Space Heating Division, The Peoples Gas Light and Coke Co., Chicago.

[1]The reader is cautioned that this factor is applicable only to Chicago or other cities where the gas has a heat content of 800 B.t.u. per cu. ft. —*Editor*

vide a partial vacuum in the combustion chamber above the fuel bed sufficient to draw an adequate supply of air through the bed of fuel to insure good combustion. When firing solid fuel a minimum draft of 0.01 in. of water pressure is necessary in order to burn 1 lb. of coal per square foot of grate surface per hour under good conditions. Since most house heating boiler and furnace ratings are based on 7 lb. of coal burned per square foot of grate surface per hour and are sometimes fired up to 10 lb., the draft pressure required will be a minimum of 0.07 to 0.10 in. water pressure.

When firing with gas in coal designed equipment, we do not require any such draft intensity because:

1. No draft is required to induce a large volume of air for combustion through the resistance of a bed of solid fuel.
2. Only a slight draft is necessary to conduct the products of combustion from the combustion chamber through the upper flue passages, and thence through the flue pipe to the chimney.

The atmospheric burner, due to the velocity of the gases issuing from the ports or nozzles, draws in sufficient primary and secondary air to take care of the normal needs for combustion. Therefore, only enough draft is required to carry the products of combustion away from the combustion chamber as rapidly as they are generated. This requires only a very small amount of draft—a matter of only a few thousandths of an inch of water pressure in the average case. When the products of combustion are carried away as rapidly as they are formed a balanced draft condition prevails in the combustion chamber and a balance is established between the rate at which the gases of combustion are generated and the rate at which they leave the combustion chamber. With such a balance there is ample draft maintained in the inlet air chamber serving the burner to supply sufficient secondary air. Normally, there is always some wind blowing outside during the heating season, so that precautions should be taken when draft is adjusted to allow for the minimum draft condition which prevails when there is practical absence of wind.

Since the time element is an important factor in heat transfer, it is obvious that the slower the gases pass through a boiler or furnace, the more heat they can give up to the heating surfaces. Therefore, it is important that the draft be at a minimum so that the gases will pass through the boiler at as low a velocity as is possible consistent with permitting sufficient secondary air to be entrained to give complete combustion with a minimum of excess.

In order to obtain the approximately correct draft conditions for conversion burner installations, the flue pipe should be sized according to the approximate gas consumption which will be used on the burner, and equipped with a good draft diverter. The size of the flue pipe is not always the same for any particular gas consumption because variations are necessary, depending on whether the boiler or furnace is of the updraft type, sidedraft type, or downdraft type, and of the latter, the degree of downdraft design. The size of the flue pipe is also influenced by the length of run between boiler and chimney and the number of turns used; the number of turns, especially 90° turns, having a much greater effect on the draft than the straight run length. Careful checking of draft on a series of cases where the approximate correct draft was maintained in the combustion chamber of the boiler or furnace, namely, about 0.003 in. water pressure at the lower level of the firing door, showed that with such low draft pressures, the effect of every 90° turn reduced the draft in the flue pipe from 20 to 25%, and each additional 90° turn further reduced the residual draft by this amount. The average job has either one or two 90° turns so that consideration must be given to a greater number of turns of this kind.

Commercial flue pipe sizes increase in one inch diameter increments. In some cases the required gas consumption may be just a little beyond the capacity of one size of flue, so that the next larger size must be used. This may result in too strong a draft, which should be corrected after the installation.

A study of drafts on a wide variety of updraft, downdraft, and sidedraft boilers and furnaces was made and the limits of gas consumption determined in each case for the various sizes of commercial flue pipes. This study was made not only to check the reliability of the conventional figure of 1 sq. in. of flue area per 7,500 B.t.u. of gas burned, but also to determine all possible variations. The data obtained showed that the conventional figure of 7,500 B.t.u. per sq. in. of flue area was appreciably too high for updraft furnaces and somewhat high for updraft boilers, whereas with downdraft types of equipment it was much too high.

The number of B.t.u. of gas burned per hour per square inch of flue area were as follows:

1. *Furnaces.* For the general run of updraft furnaces having not over two 90° elbows in the flue pipe—6,600 B.t.u.

   For the general run of updraft furnaces, but having three or four 90° elbows in the flue pipe—6,000 B.t.u.

   For downdraft furnaces, where the flue products in their travel through the flue passages descend to a level approximately one foot higher than the grate line—5,450 B.t.u. This includes the general run of steel furnaces with rear radiators.

   For downdraft furnaces where the flue products in their travel through the flue passages descend to the level of the grate line—4,000 B.t.u.

   For downdraft furnaces where the flue products in their travel through the flue passages descend to a level below the ashpit of the furnace—the extreme of downdraft—about 3,000 B.t.u. With such furnaces the flue is not sized but the full size flue is used.
2. *Boilers.* For the general run of round, square, and rectangular sectional boilers of the updraft type and having one or two elbows in the flue pipe—7,350 B.t.u.

   For the general run of round, square, and rectangular sectional boilers of the updraft type, where the flue pipe from the reducing collar on consists of only a short straight horizontal run with no turns—9,000 B.t.u.

For small boilers of the Arcola type — 6,350 B.t.u.

For downdraft types of boilers, where the lowest flue passages are below the grate line level— 5,400 B.t.u.

Apparently, furnaces offer more resistance to the flow of flue gases than boilers. A partial influence is the fact that the average furnace job has two 90° turns in the flue pipe while the average boiler job has only one.

The accompanying charts (Figs. 1 and 2) are based on the above data for sizing flue pipes when using 800 B.t.u. mixed gas. The curves are so plotted that the range of any one size of flue occurs between two size lines, that is, the lower limit of a 5-in. pipe in Curve I in Fig. 1 would be 110 cu. ft. per hr. gas consumption, which is, at the same time the upper limit of a 4-in. pipe, and the upper limit for a 5-in. would be 195 cu. ft. per hr. Hence the upper limit of any one size of flue is at the size line.

The entire procedure is based on the use of a good draft diverter, which meets all the specifications of what a draft diverter should do. Two types were in use on all the cases used in the investigations, namely, the conventional vertical or bell type and the type we call the "universal" which was developed in Chicago especially for horizontal use, but which can also be used at any angle from horizontal to vertical with equally good results.

The draft diverter should always be installed as close to the chimney as possible because more heat will be radiated to the basement from the flue, and dilution of the flue products will occur just before the chimney. When the vertical or bell type draft diverter is used it should be installed as high as possible, at least higher than the high point of the flue passages, which permits obtaining the advantage of additional flue action.

Bricked-in Breechings

Various jobs are encountered where the boiler is brickset and the breeching is bricked-in. Such breechings are usually short straight runs and the equivalent of sizing a flue must be done in order that excessive draft be avoided. In cases of this kind the boiler is usually of the steel horizontal fire-tube type and the chimneys are larger and higher than those usually encountered in ordinary residential work. The breechings are usually of considerable cross section and if the job is operated "as is" terrific drafts are the rule. They have been known to make it difficult to avoid sucking the flame off the burner. Therefore, it becomes necessary to size the breeching with an orifice and also install a draft control. An orifice is installed in the breeching close to the chimney which has an opening in square inches of area based on the hourly gas consumption to be used on the burner. It has been found that every 13 cu. ft. (of 800 B.t.u. gas) consumed per hour (10,400 B.t.u.) requires 1 sq. in. of orifice opening, in addition to a draft control (see Fig. 3).

The draft control we generally use locally is of the circular type which rides on two knife edges. This device is installed on the side of the breeching *between* the orifice and the boiler. It is a good policy always to install the largest size of draft control that the dimensions of the breeching will accommodate. This type of draft control does a fairly good job of controlling the updraft, but is comparatively poor in handling downdrafts, because it only partially prevents downdraft from blowing through the boiler and does not vent the appliance to the basement. On very wide breechings install the draft control on the side of the breeching nearest the orifice. If the breeching is so short that it is impossible to install any draft control on it, then it becomes necessary to install it on the chimney, but it must always be installed above where the breeching enters the chimney so that the draft is broken ahead of the point where the breeching enters the chimney. The size of the draft control in this case should be at least four times the size of the orifice and preferably as large a size as the inside dimensions of

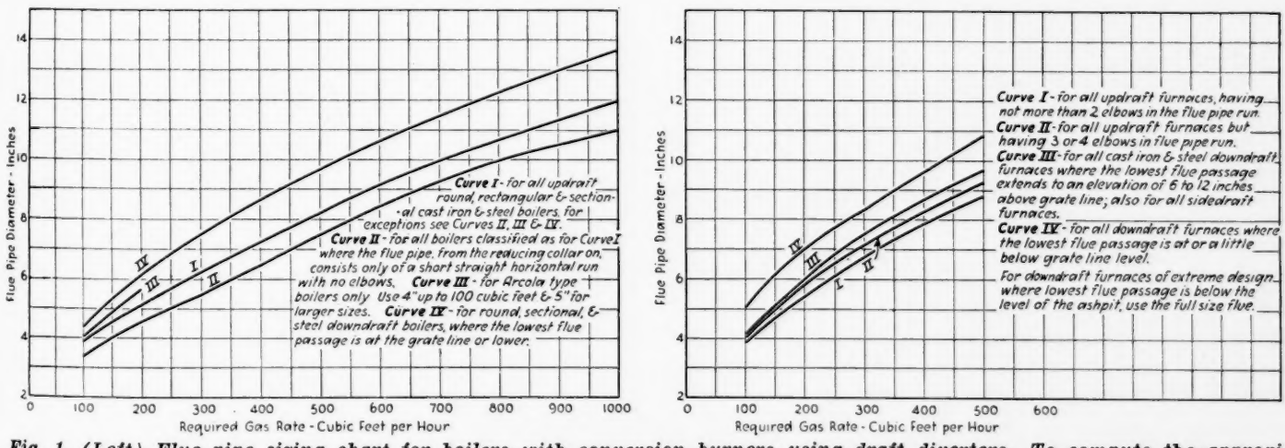

Flue Pipe Diameter - Inches
Required Gas Rate - Cubic Feet per Hour
Curve I - for all updraft round, rectangular & sectional cast iron & steel boilers, for exceptions see Curves II, III & IV.
Curve II - for all boilers classified as for Curve I where the flue pipe, from the reducing collar on, consists only of a short straight horizontal run with no elbows. Curve III - for Arcola type boilers only Use 4" up to 100 cubic feet & 5" for larger sizes. Curve IV - for round, sectional, & steel downdraft boilers, where the lowest flue passage is at the grate line or lower.
Curve I - for all updraft furnaces, having not more than 2 elbows in the flue pipe run.
Curve II - for all updraft furnaces but having 3 or 4 elbows in flue pipe run.
Curve III - for all cast iron & steel downdraft furnaces where the lowest flue passage extends to an elevation of 6 to 12 inches above grate line; also for all sidedraft furnaces.
Curve IV - for all downdraft furnaces where the lowest flue passage is at or a little below grate line level.
For downdraft furnaces of extreme design where lowest flue passage is below the level of the ashpit, use the full size flue.

Fig. 1. (Left) Flue pipe sizing chart for boilers with conversion burners using draft diverters. To compute the approximate required hourly gas consumption multiply the net hourly B.t.u. heat loss in thousands by 2.5 to obtain the gas rate per hour in cubic feet. The curves are so plotted that the upper limit for gas consumption on each size of flue is on the size line. Fig. 2. (Right) Flue pipe sizing chart for furnaces with conversion burners using draft diverters. To compute the approximate required hourly gas consumption for jobs having less than 60,000 B.t.u. per hr. heat loss multiply the heat loss in thousands by 2.4 to obtain the gas rate in cubic feet per hour. If the job has more than 60,000 B.t.u. per. hr. heat loss use a multiplier of 2.2. The curves are so plotted that the upper limit for gas consumption on each size of flue is on the size line.

the chimney will accommodate. If there is not sufficient room to install a draft control above the breeching on the chimney, it is necessary then to install it below where the breeching enters the chimney and, in a case like this, the size of the draft control must be at least six times the size of the orifice. Here, also, use as large a draft control as the inside width of the chimney will accommodate.

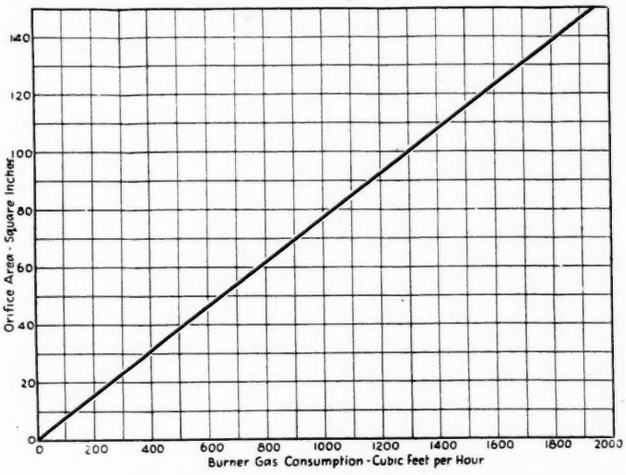


Fig. 3. Orifice sizing curve for bricked-in breechings. The curve is based on an allowance of 1 sq. in. orifice area for each 13 cu. ft. of 800 B.t.u. gas and using a pendulum type of draft control.

If it should be desired to use a draft control instead of a draft diverter, on a case where the flue is sized, it will be necessary to size the flue one commercial size smaller than ordinarily because the draft control does not break the draft to the extent that a draft diverter does. It is also necessary to use a draft control which is two inches greater in diameter than the flue pipe and install it on the side of the flue pipe so that it will break the draft ahead of the point where the connection to the boiler occurs. By so doing, the draft on the appliance will be maintained near the proper point but will be subject to more variation as the chimney draft varies than is the case where a draft diverter is used. It is advisable never to use such draft controls except in cases where a regular draft diverter can not be used.

Water Coils and Heat Exchangers

Since people who are used to a water coil in a firepot or a heat exchanger dislike to discontinue its use, they should be discouraged in their idea of retaining it because—

1. It does not supply hot water for nothing.
2. The position of the coil may interfere with the proper installation of the burner.
3. With intermittent firing, unsatisfactory hot water service is obtained except in severe weather.
4. However, if the customer insists on retaining the coil, abide by his decision and do the best you can.

If the position of the coil interferes with the proper placing of the burner it should be raised. The coil should always be high enough to avoid contact with the gas flame because incomplete combustion, due to chilling the gases, will result. Near the top of the combustion chamber is the best place for a firepot coil. An allowance of 3 sq. ft. of radiator per gal. of tank capacity for a hot water system and 2 sq. ft. for a steam system should be made and added to the standing radiator load.

Heat exchangers for water heating directly have a cooling action on the boiler water as long as circulation continues and since they have a greater capacity than the average coil, they often provide more hot water than is necessary. A valve should be installed on the return line between the exchanger and the boiler so that the flow of boiler water through the exchanger can be controlled and kept at a minimum. The allowance to be made is the same as for water coils. With a submerged coil in a steam boiler connected to a storage tank an allowance of ½ sq. ft. of radiator per gallon of storage tank capacity should be made. A somewhat higher hourly gas consumption will be required on any job where a water coil or heat exchanger is in use to offset the heat utilized in heating the water.

After the installation has been made it might be concluded that the job is almost complete. This is not the case, as the author points out in the next installment in which he enumerates the engineering to be done after the installation is made.

Low Humidity Causes Loss of Hair

THE lack of humidity along with too much heat in winter heating is a major cause of hair loss and marred complexions, starting at about this time of the year, Paul A. Thomas, noted scalp specialist, declared recently.

Overheated dry air and poor ventilation in homes and offices where most people now spend three-quarters of their time contribute to thousands of new cases of skin and scalp trouble every winter, he said. Hot air which lacks sufficient moisture dries the scalp and skin, and stifles normal functions of the glands and pores.

The irritations and dry, parched conditions result in sallow or otherwise blemished complexions and stimulate the glands which bring baldness to men and rob women's hair of its health and lustre.

Room temperatures of 70° to 72° and 40% to 45% relative humidity, with slightly lower humidity if outside temperatures get abnormally low, are best. They help correct these evils and stimulate personal appearance. Similarly, the higher humidities are agreed upon by most authorities as being of maximum benefit to health and comfort.

EDITORIALS

Comfort Conditioning in Factory Buildings

Having but lately seen the newly air conditioned factory spaces at the Ford plant in Detroit and noted how comfortable they are, we feel that allusion may well be made to another personal incident. Some months ago a group of Russian engineers visited this country to collect information on heating, ventilating, and air conditioning practice here. They stopped in our office and among other requests asked that they be directed to the best of our air conditioned foundries. The request was made evidently with the thought that air conditioned foundries are a matter of everyday experience here. Now that was where we were rather badly taken back, for no amount of thought seemed to bring to mind any case where a metal foundry was equipped with year 'round conditioning, and we caught the impression that our Russian visitors thought we must be either ill-informed or that we were holding back information. Moreover, we thought it was time to gather a little information ourselves and asked the interpreter if summer cooling for comfort was practiced in Russian factories. We were assured that plans for new factories make provision for it. We are still vague as to the actual status, but the fact that these Russian engineers were interested in purely comfort conditioning in industry was itself a little startling for we knew at the time that most of our American engineers were leaning toward the idea that process conditioning is about all that can be expected in factory buildings here.

With the comfort installations put into factories during the past few months we not only now have some examples to which to refer inquiring visitors from abroad, but we dare say that when the results are better known there will be a revival of interest on the part of our leaders of thought which will eventually make for better working conditions in factories. There is still an excellent likelihood that numerous cases can and will be found where savings in labor turnover, in decreased spoilage, in better quality and quantity of factory output will be provable beyond dispute. Just now they are hard to demonstrate in detail because of a lack of dependable experiences resulting from purely comfort applications in industry. Every one properly made brings us just a little closer to convincing proof.

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Standard Ratings for Condensers and Compressors

After two years of intensive work on the part of a joint engineering committee representing trade associations and technical groups, standards for rating and testing mechanical compressors and condensers for air conditioning applications are now in existence bearing the approval of the most interested trade associations. Full details of the standards will be available shortly.

Everyone seems agreed that air conditioning is badly in need of standards in a number of directions, and that the lack of really good standards is rapidly becoming a major problem. Standards of application and installation are necessarily closely related to—and almost impossible of achievement without—standardized information on the performance of air conditioning apparatus itself. No matter how carefully performance requirements may be worked out, there is no way of knowing how nearly actual performance of the completed job will approach that desired unless the performance of the individual equipments are available. This newest move is a step toward the general objective of putting air conditioning on a more satisfactory basis than it has enjoyed heretofore.

Indications are that with the trade associations interested, with independent committees working, and with thought being given to standardization by many individuals who are neither organized nor vocal, we shall see the situation greatly improved before long. Substantial improvement is badly needed for the present confusion is demonstrably holding back jobs which would otherwise go ahead.

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Domestic Stokers Step Out

There are always developments of interest to engineers and contractors along the battlefront between the fuels for domestic heating purposes. This struggle goes on without end and fortune smiles first on one and then another of the contenders. Latest of these interesting developments is the sales record being piled up currently by coal burning stokers. Best available reports indicate that whereas last year oil burners outsold stokers in the ratio of 4.5 to 1, this ratio has been reduced to 3.5 to 1 for the first eight months of this year. For one month the reports show that this ratio fell as low as 3 to 1.

This is a swift shift in these significant ratios and shows how rapidly the coal burner is making headway in this particular field. Whether it means anything more or whether it is the beginning of a permanent trend only time will tell. At present it is more an item of interest than anything else. It is also interesting to note that in many localities domestic stokers and oil burners are now available at substantially the same price installed. No one can yet accurately predict their future price trends relative to each other or the effects of any nearby shifts in the prices of the two fuels themselves. Neither does it seem that either device has been so fully developed that there are not still excellent possibilities that engineers may still play their important part in the final outcome of the struggle for the domestic fuel market.

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Federal Housing Prospects

Among the most promising of the Roosevelt proposals to help build up volume for the construction industry are those having to do with housing and slum clearance. When these plans were brought forward two years ago engineers and contractors at once envisioned huge apartment house groups being rapidly erected. In the main these hopes have not materialized for few of those proposed jobs have actually got under way.

For some time there has been so much confusion regarding the progress of these projects, so much discussion of the principles involved, so much litigation over sites and contracts, and so much shifting of funds and stated objectives that it has been virtually impossible to find just what is going on currently and what is still projected.

Now comes word that under the latest plan a total expenditure of some $125 million on about 50 projects located in about 35 cities will be the final result of all the preparation and agitation on this subject. It is also reported that most of these projects are in such shape that they may not only reasonably be expected to be carried through to completion but that they are to be actively pushed. As but few of them have reached the contract stage they can still be looked on as potential business by both engineers and contractors. There is probably more likelihood than ever now that these housing groups will really materialize during 1936. Elsewhere in this issue there is a summary showing how these projects stand at present. If these projects carry through next year and are added to the already large amount of private apartment construction, there is no doubt that 1936 will be the biggest year in apartment construction which has been experienced since the days of 1928 and '29.

Degree-Days and Unit Fuel Consumption—September, 1935

Continuing HEATING & VENTILATING's eighth year of publishing degree-day data for various large cities in the United States

	Atlanta	Baltimore	Birmingham	Boston	Buffalo	Chicago	Cincinnati	Cleveland
Degree-days for September, 1935.....	1	36	—	126	176	94	59	94
Degree-days for September, 1934.....	—	2	—	53	77	90	28	57
Degree-days for September, Normal....	—	—	—	48	75	3	—	27
Lb. coal per sq. ft. rad., September, '35	0.008	0.288	—	1.008	1.408	0.752	0.472	0.752
Gal. oil per sq. ft. rad., September, '35	0.001	0.025	—	0.086	0.121	0.064	0.040	0.064
Cu. ft. gas per sq. ft. rad., September, '35	0.10	3.46	—	12.10	16.90	9.02	5.66	9.02

	Denver	Des Moines	Detroit	Duluth	El Paso	Fort Wayne	Grand Rapids	Harrisburg
Degree-days for September, 1935.....	144	87	144	366	16	102	140	79
Degree-days for September, 1934.....	185	168	76	367	—	83	96	29
Degree-days for September, Normal....	72	—	42	261	—	—	57	—
Lb. coal per sq. ft. rad., September, '35	1.152	0.696	1.152	2.928	0.128	0.816	1.120	0.632
Gal. oil per sq. ft. rad., September, '35	0.099	0.060	0.099	0.251	0.011	0.070	0.096	0.054
Cu. ft. gas per sq. ft. rad., September, '35	13.82	8.35	13.82	35.14	1.54	9.79	13.44	7.58

	Hartford	Indianapolis	Kansas City	La Crosse	Los Angeles	Louisville	Memphis	Milwaukee
Degree-days for September, 1935.....	127	61	47	145	—	33	17	107
Degree-days for September, 1934.....	38	68	98	199	4	21	11	143
Degree-days for September, Normal....	48	—	—	96	—	—	—	84
Lb. coal per sq. ft. rad., September, '35	1.016	0.488	0.376	1.160	—	0.264	0 136	0.856
Gal. oil per sq. ft. rad., September, '35	0.087	0.042	0.032	0.099	—	0.023	0.012	0.073
Cu. ft. gas per sq. ft. rad., September, '35	12.19	5.86	4.51	13.92	—	3 17	1.63	10.27

	Minneapolis	New Haven	New Orleans	New York	Oklahoma City	Omaha	Peoria	Philadelphia
Degree-days for September, 1935.....	153	95	—	67	33	80	94	41
Degree-days for September, 1934.....	247	34	—	16	40	159	108	8
Degree-days for September, Normal....	93	39	—	—	—	—	3	—
Lb. coal per sq. ft. rad., September, '35	1.224	0.760	—	0.536	0.264	0.640	0.752	0.328
Gal. oil per sq. ft. rad., September, '35	0.105	0.065	—	0.046	0.023	0.055	0.064	0.028
Cu. ft. gas per sq. ft. rad., September, '35	14.69	9.12	—	6.43	3.17	7.68	9.02	3.94

	Pittsburgh	Portland, Ore.	Providence	Reading	Rochester	St. Louis	Salt Lake City	San Francisco
Degree-days for September, 1935.....	94	28	102	83	171	38	38	161
Degree-days for September, 1934.....	42	115	32	36	65	60	145	90
Degree-days for September, Normal....	—	105	63	—	72	—	18	114
Lb. coal per sq. ft. rad., September, '35	0.752	0.224	0.816	0.664	1.368	0.304	0.304	1.288
Gal. oil per sq. ft rad., September, '35	0.064	0.019	0.070	0.057	0.117	0.026	0.026	0.110
Cu. ft. gas per sq. ft rad., September, '35	9 02	2.69	9.79	7.97	16.42	3.65	3.65	15.46

	Scranton	Seattle	Spokane	Syracuse	Toledo	Trenton	Washington, D. C.	Wichita
Degree-days for September, 1935.....	152	98	99	183	114	74	40	35
Degree-days for September, 1934.....	57	180	262	53	72	27	6	85
Degree-days for September, Normal....	60	192	192	96	9	—	—	—
Lb. coal per sq. ft. rad, September, '35	1.216	0.784	0.792	1.464	0.912	0 592	0.320	0.280
Gal. oil per sq. ft. rad., September, '35	0.104	0 067	0.068	0.125	0.078	0 051	0.027	0.024
Cu. ft. gas per sq. ft. rad., September, '35	14.59	9.41	9 50	17 57	10.94	7.10	3 84	3.36

Fuel consumption figures given above are based on certain conditions, and for other conditions corrections must be made. The figures assume the use of steam radiators emitting 240 B.t.u. per sq. ft. per hr., a system operating at 100% efficiency, and radiators calculated for maintaining 70° in zero weather. Heating values assumed for the fuels are 12,000 B.t.u. per lb. for coal, 1000 B.t.u. per cu. ft. for gas, and 140,000 B.t.u. per gal. for oil. To correct for other heating values, efficiencies, and design conditions, follow the method explained in the "Heating and Ventilating Degree-Day Handbook." Degree-days as given above for "a normal" month or season are based on averages for a long period of years, ending about 1922. Averages covering different periods will disagree with the above figures slightly.

The Degree-Day Explained

THE degree-day as an estimating unit for fuel consumption in connection with the heating of buildings has been in wide use since 1925, and its popularity is still growing. Since 1927 HEATING & VENTILATING has published monthly figures on the number of degree-days for different cities, and in 1930 published the HEATING & VENTILATING *Degree-Day Handbook* which gave normal degree-day figures for 1000 cities by months. These activities undoubtedly contributed to the ever-increasing use of the degree-day unit.

A brief outline of the uses of the degree-day unit, together with instructions as to how it can be used, follows:

The degree-day is based on the fact that the amount of fuel used in the heating of buildings is proportional to the number of degrees the outside temperature falls below (about) 65°. This base temperature was found to be 65° for residences and for other buildings as follows:

Office buildings	66.2°
Stores	64.0°
Apartments	68.8°
Service buildings	61.2°

However, all of these are near enough to 65° so that that figure can be used for all practical purposes.

The number of degree-days per day is the difference between 65° and the outside temperature when the outside temperature is below 65°. (If the outside temperature is above 65°, there are no degree-days.) On a day, for example, when the outside temperature is 60° there are four degree-days that day. Totalling these for the month gives the number of degree-days for that month, and this is a measure of the amount of fuel which is used for the heating of buildings in a given locality.

Obviously the number of degree-days varies from city to city and in each city from year to year. The average or normal number of degree-days (as given in HEATING & VENTILATING's *Degree-Day Handbook*) is the average number of degree-days for each month of the heating season based on weather bureau records for a long number of years.[1] A comparison of these normal degree-days for a given month for a given city with current monthly figures for that city shows how much fuel should be used currently relative to an average month or year.

The accompanying table gives the number of degree-days for an average year in two different cities and also for the heating season 1934 and 1935.

Referring to this table we see that a Philadelphia building should have used 4759 ÷ 4855 or 98% as much fuel in the season 1934-35 as during an average year. Similarly, a St. Louis building during that season

	PHILADELPHIA		ST. LOUIS	
	"AVERAGE" DEGREE-DAYS	1934-35 DEGREE-DAYS	"AVERAGE" DEGREE-DAYS	1934-35 DEGREE-DAYS
September	—	8	—	60
October	242	280	205	114
November	588	433	597	443
December	905	902	936	983
January	1,001	1,052	1,060	985
February	893	893	854	739
March	756	584	657	436
April	402	412	276	397
May	68	182	—	162
June	—	13	—	14
TOTAL	4,855	4,759	4,585	4,303

should have used 4303 ÷ 4585 or 94% as much fuel as in a normal year.

Consequently, it can be seen that the degree-day is a useful unit, not only in estimating monthly and yearly requirements for fuel consumption, but in determining the reasons for excessive consumption of fuel. For example, if a complaint by a homeowner is made that his January fuel bill is running far in excess of his November bill a check against the degree-day totals for the two months shows whether the increased consumption is in proportion to the increase in degree-days. If the increases agree, then the rise in fuel consumption indicates only the difference in severity of weather.

In determining the amount of fuel which should be used for a given building per degree-day the following figures can be used with *corrections as outlined later:*

0.0006857 gal. of oil per sq. ft. of steam radiator per degree-day; 0.008 lb. of coal per sq. ft. per degree-day; and 0.096 cu. ft. of gas per sq. ft. per degree-day. These figures apply to a steam system designed to maintain 70° in 0° weather, 100% efficiency of the plant, and for heating values of the fuel as follows: 140,000 B.t.u. per gal. for oil; 12,000 B.t.u. per lb. for coal, and 1,000 B.t.u. per cu. ft. for gas.

These figures must be corrected if the system is other than steam by multiplying by ⅝ for hot water. For warm air the uncorrected unit figures are as follows:

	LB. OF COAL PER DEGREE-DAY PER SQ. IN.	CU. FT. OF GAS PER DEGREE-DAY PER SQ. IN.	GAL. OIL PER DEGREE-DAY PER SQ. IN.
First floor leader	0.0037	0.044	0.000318
Second floor leader	0.0056	0.067	0.000477
Third floor leader	0.0067	0.080	0.000571

An additional correction must be made for the heating value of the fuel used. The figures which are given are based on the heat content of 140,000 B.t.u. per gal. of oil, 12,000 B.t.u. per lb. of coal, and 1,000 B.t.u. per cu. ft. for gas. For other heating values multiply these by the fraction

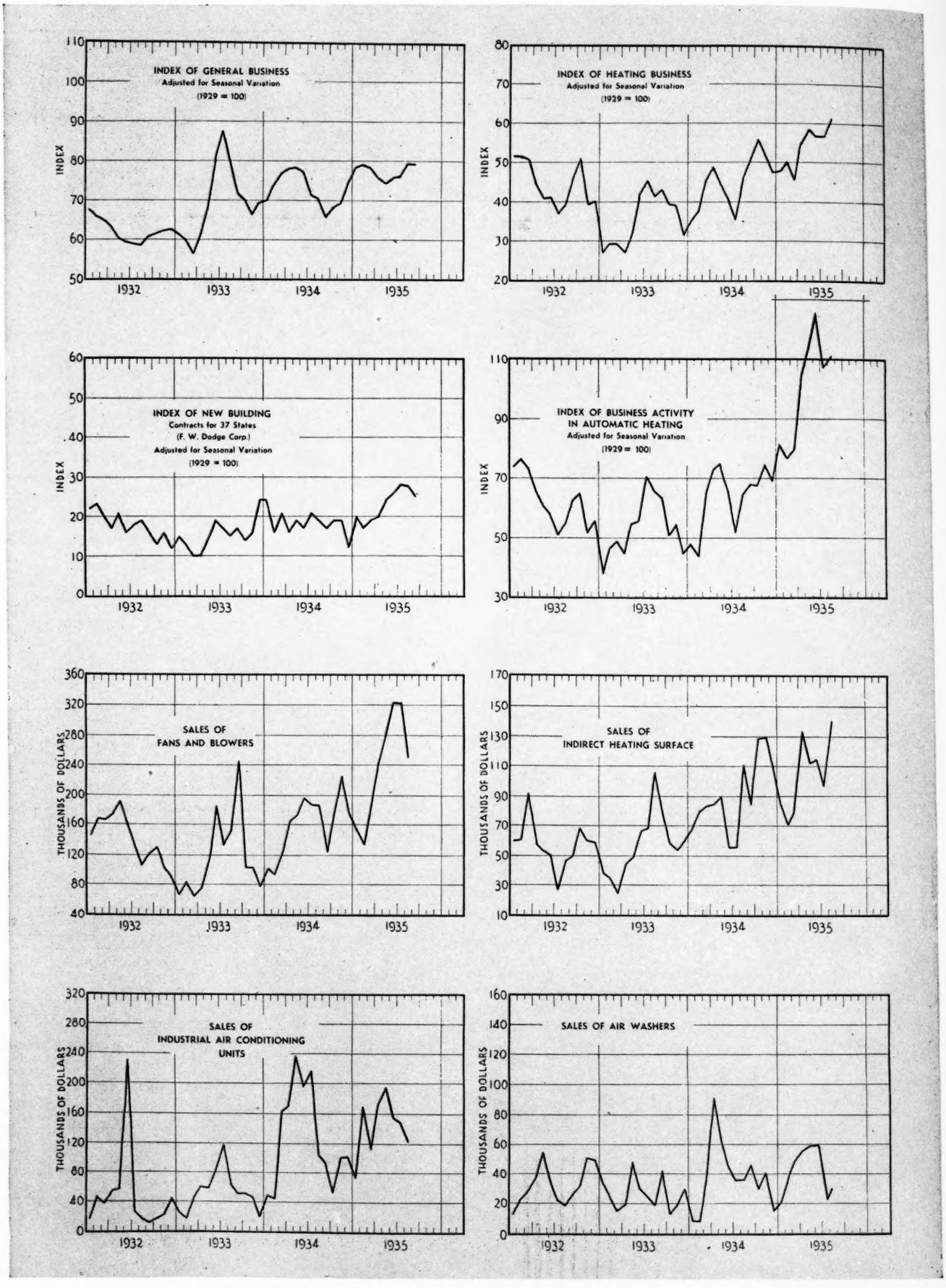
$$\frac{\text{heat value given above}}{\text{heat value of fuel actually used}}$$

Still another correction must be made for the design temperature for which the radiators were designed. The unit figures given are for systems designed to maintain

(Continued on page 72)

[1]Obviously, the exact figure in the average for any city depends on the particular years which are averaged. Figures used by HEATING & VENTILATING as averaged for a given city are the averages for a period ending approximately 1922 and beginning back as far as 50 years for some cities, depending on the data available for that city. Some organizations independently calculating the averages use records for more recent years which give slightly different figures but which do not differ from others by more than 1%. Since the degree-day cannot be used within a limit of accuracy of 1%, it makes but very slight difference which averages are used.

BUSINESS TRENDS



Heating Index Up in August

SHARP increases over last year in sales of some kinds of heating equipment, with a few small declines in others, and a slight drop-off in ventilating and air conditioning sales featured August business news. It begins to be apparent, however, that in all of these lines 1935 will show an improvement over 1934 when the year finally closes.

September building reports were not startling. Notable gains are apparent over last year for 1935 so far, but September activities were not quite as great as August after adjustment is made for seasonal trend.

The marked gain in oil burner shipments during August was almost entirely attributable to the sudden jump in natural draft burner business, begun during July. Sales of these increased from 429 in August, 1934, to 2,112 in August of this year. Warm air furnace-burner units also showed up favorably, rising from 114 sales in August of last year to 313 in the same month of 1935.

Cast iron convectors and residential stokers shared in the greatest gains of the month as compared with

(Continued on page 73)

HEATING BUSINESS TRENDS AND EQUIPMENT SALES

Equipment	August, 1935	August, 1934	8 Mo., 1935	8 Mo., 1934
Oil burners, number of units shipped in U. S., mechanical draft type	12,493	8,642	52,190	35,562
Boiler-burner units, number shipped in U. S.	1,143	1,159	5,174	4,227
Ventilating blowers, orders in dollars	64,883	84,866	642,148	497,831
Small housed blowers and propeller fans, orders in dollars	185,473	110,402	1,296,250	867,902
Air washers, orders in dollars	24,350	35,970	336,242	385,177
Industrial air conditioning units, orders in dollars	123,501	104,726	1,152,875	1,296,805
Industrial unit heaters, orders in dollars	299,586	265,964	1,796,297	1,553,395
Schoolroom unit ventilators, orders in dollars	132,012	152,586	1,023,288	837,457
Non-ferrous indirect heating surface, orders in dollars	121,706	103,684	747,515	554,306
Cast iron indirect heating surface, orders in dollars	16,035	6,960	69,763	56,241
Residential stokers, sales in number of units	4,928	1,976	16,274	6,407
Steel boilers, orders in square feet of heating surface	216,510	153,087	1,167,063	614,785
Cast iron round boilers, shipments in thousands of pounds	4,368	4,571	22,595	23,458
Cast iron square boilers, shipments in thousands of pounds	21,689	17,890	92,535	80,961
Cast iron radiators, shipments in thousands of square feet	6,470	5,336	27,735	23,954
Non-ferrous convectors, sales in square feet, elements only	73,768	62,262	478,410	513,464
Non-ferrous convectors, sales in square feet, with cabinets	243,406	178,160	1,063,967	890,753
Cast iron convectors, sales in square feet	423,581	151,303	1,608,397	841,937
Indexes (1929 = 100), Seasonally Adjusted			8 Mo. Average, 1935	8 Mo. Average, 1934
Heating & Ventilating's Index of Heating Business	61.0*	45.5	53.8	41.7
Heating & Ventilating's Index of Automatic Heating	110.7*	64.6	99.8	61.2
Heating & Ventilating's Index of Heating Contractor Activity	48.4	39.8	41.3	35.3
	September, 1935	September, 1934	9 Mo. Average, 1935	9 Mo. Average, 1934
New Building Contracts	25.0	17.0	23	19.0
Heating & Ventilating's Index of Stock Prices, 11 Manufacturers, unadjusted, unweighted	50.5	25.6	37.9	26.3

*Preliminary figure.

SUMMER AIR CONDITIONING INSTALLATIONS REPORTED BY 17 UTILITIES FOR SEPTEMBER, 1935†

City	September, 1935		September, 1934		Nine Months, 1935		Nine Months, 1934	
	No.	Hp.	No.	Hp.	No.	Hp.	No.	Hp.
Boston	5	655½	4	13½	51	1,501½	42	2,711
Chicago	15	338	3	930	298	5,240	230	5,410
Cincinnati	0	0	—	—	93	2,451½	—	—
Dallas	2	12¼	—	—	69	1,234	—	—
Detroit[1]	4	12	—	—	88	2,781½	—	—
Hartford	2	6	—	—	14	172	—	—
Houston	3	427	1	20	30	2,727	28	360
Manhattan and Bronx	4	36½	—	—	193	7,226	—	—
Newark[2]	5	22¾	15	77¾	89	1,031	90	509¾
Philadelphia	8	1,136	6	75	133	4,640	143	2,267
Pittsburgh	2	20½	—	—	91	1,343¼	—	—
Queens	0	0	0	0	9	161¼	23	268
Rochester	2	4¼	—	—	25	477¼	—	—
Scranton	1	35	—	—	9	138	—	—
San Francisco[3]	18	25	22	185	119	699	176	407
Toledo	1	2	0	0	23	426	0	0
Washington	16	80	2	55	159	7,112½	75	9,442
Total, 17 Reports	88	2,812¾	—	—	1,459	38,361¾	—	—
Total, Those Reporting Both Years	71	2,686¼	53	1,356¼	911	23,538	807	21,374¾

†Dash indicates no report, not that no jobs were installed.
[1]During the summer an industrial plant in this city installed a 1500-hp. washed air system, not included in these figures.
[2]Includes Jersey City and other localities served by Public Service Electric & Gas Co.
[3]Includes all territory served by Pacific Gas & Electric Co.

ABSTRACTS of Current Papers, Books and Pamphlets

Fundamentals of Industrial Marketing

While there have been available for many years numerous books and studies on the subject of marketing agricultural and other consumer goods, until the last few years there has existed practically no comprehensive literature on the subject of industrial marketing. Such a book has now been prepared by Robert F. Elder, associate professor of marketing, Massachusetts Institute of Technology. It describes how industrial goods are bought and sold, the distribution channels through which industrial products move, policies and operating plans affecting them, and industrial market research. The industrial sales organization, its training and control are also treated.

Since industrial advertising differs widely from advertising of consumer goods this subject is treated in some detail. Chapters on this subject include those on industrial sales promotion, engineering service, and industrial advertising.

[*"Fundamentals of Industrial Marketing," by Robert F. Elder, published by McGraw-Hill Book Co., Inc., 330 West 42 St., New York; 6 in. x 9 in., 317 pages, 47 illustrations; price $3.*]

Data on Consumer Survey of Fargo and Columbia

More homes equipped with central heating systems, installed bathing facilities, gas for cooking and electricity for lighting were reported in 1934 by families in Fargo, N. D., whose annual incomes for the preceding year were between $1,000 and $1,500, than by consumers within any one of the five higher income classes, according to the Bureau of Foreign and Domestic Commerce, in announcing completion of the Fargo study on "Consumer Use of Selected Goods and Services by Income Classes." Families within the income class referred to represent 21% of that city's population.

In Columbia, S. C., heating stoves are used by almost 35% of all reporting families, while only about 20% have central heating plants. The remaining families use equipment reported as "other" and interpreted to be fireplaces, chiefly. Nearly 71% of the families with less than $500 annual income and over 50% of all tenant families report the use of facilities other than stoves or furnaces. In contrast, only 26% of all homeowners use "other" heating apparatus.

Evidence that owner-occupancy families are more inclined to have central heating plants than are tenant families is found in the fact that, while in this city there are more than two and a half times as many tenants as owner-occupants, the total number of owner-occupant homes with central heating apparatus is almost as great as the number of tenant homes so equipped. The white owner-occupant group exceeds all other racial and tenancy groups in the use of heating plants. Over 40% of these families have some type of central system.

A larger percentage of heating stove users is reported by the group of families with incomes of between $1,000 and $1,500 than by any other one income class. Approximately half of these families have heating stoves. Families with incomes of less than $1,000 in 1933 have almost 85% of all reported users of "other" equipment, more than half of the users of stoves and about 42% of the homes equipped with hot water systems.

Users of heating plants show a preference for the warm air system. Though considerably more than one-third of all families in the three highest income classes report the use of warm air furnaces, the group of families having incomes of between $3,000 and $5,000 is outstanding in consumption of this equipment. Slightly more than 46% of the families in this income class live in dwellings heated with warm air.

The close relationship between family income and the use of central heating apparatus of some kind is clearly shown by the fact that three-fourths of all families in the two highest income classes own or rent homes equipped with heating plants.

Coal is used for house heating purposes by about 67% of all families in Columbia. Less than one-third of the family population burn wood, and other kinds of heating fuel are consumed in only about 2% of all homes. Approximately 90% of the white families reported coal as the principal fuel used, while nearly two-thirds of the Negro families depend on wood for heat.

Almost 97% of all families using wood for house heating fuel had incomes of less than $1,000 in 1933, and more than three-fourths of them had less than $500. In point of actual numbers, there are more coal users (21.7% of the total) in the group of families reporting incomes between $500 and $1,000 than in any other group. This is to be expected from the fact that this income class contains so large a share of all white families in the community. However, as compared with this group, a larger percentage of families within each of the higher income classes use coal in preference to other house heating fuels.

This new material showing the relationship between income and consumption is of national interest since the manufacturers of the products included in the study are located in various sections of the country. The report provides factual data designed to be of practical value to manufacturers, wholesalers and retailers of the specified commodities whose sales territories include this city or similar communities, it was stated.

[*"Consumer Use of Selected Goods and Services, by Income Classes—Fargo, N. D." Market Research Series No. 5.2. By Ada Lillian Bush, chief of the Consumer Marketing Section, Bureau of Foreign and Domestic Commerce, Department of Commerce, from which the bulletin can be obtained for 10 cents. A similar bulletin covers Columbia, S. C.*]

Arc Welding Handbook

The third edition of this well known book on welding is considerably larger than the preceding volume. Rapid progress in the art of welding has made it necessary to add a large amount of data and factual information in order to bring it up to date even though the previous edition had only been published in January, 1934.

In all some 140 pages have been added to the book. Some of the additions which will be of special interest include information on speed and costs of making all types of welds in sheet metal, flame cutting, speed of welding pipes, and use of arc welding for repairing tools.

[*"Procedure Handbook of Arc Welding Design and Practice," published by the Lincoln Electric Co., Cleveland, Ohio. Third edition, semi-flexible binding, 6 in. x 9 in.; 596 pages. Price including postage in United States $1.50. Foreign postage 50 cents additional.*]

AIR CONDITIONING CHART. A new psychrometric chart designed to give greater accuracy and to be more easily read than the usual chart. The chart is for permanent use at desk or drawing board, is printed in light brown and black and is on a foundation of a laminated resinous substance similar to bakelite. Pencil lines of any color may be either washed or erased easily from the chart. [*Psychrometric Chart For Air Conditioning Computations. Size 14 in. x 20 1-2 in. Obtainable from Air Conditioning Department, General Electric, Bloomfield, N. J., or from any of its air conditioning dealers. Price $2.50.*]

NEWS OF THE MONTH

Refrigeration Rating Standards Adopted

CHICAGO—The annual meeting of the Refrigerating Machinery Association, held at the Palmer House, Chicago, October 11, disclosed a feeling of business optimism in that field of industry for the first time in several years.

Of outstanding importance in the actions taken at the annual meeting was the adoption of standard methods for testing mechanical condensing units. These standards were proposed after months of study by a joint committee composed of manufacturers' association representatives and the ASRE. It is planned that manufacturers will test and rate their equipment according to these approved standards and certify ratings of their equipment to a central bureau.

Much discussion centered around a program which has been evolving in the Chicago area for a number of months to standardize the requirements of air conditioning installations in that city.

The broad standardization program presented to the meeting of the Refrigerating Machinery Association by the standards committee was enthusiastically adopted. This will embrace practically every type of equipment and many trade practices in the industry.

Officers and executive committee for the coming year were elected. These are: president, D. Norris Benedict, vice-president and general manager, Frick Company, Inc.; first vice-president, J. M. Fernald, general manager, Baker Ice Machine Company, Inc. These, with the following, will constitute the executive committee: A. H. Baer, vice-president, Carbondale Machine Corp.; G. A. Heuser, secretary-treasurer, Henry Vogt Machine Co.; J. I. Lyle, president, Carrier Engineering Corp.; W. S. Shipley, president, York Ice Machinery Corp., and Emil Vilter, chairman of the board, The Vilter Manufacturing Co.

Only 35% of Plumbers and Gas Utilities Cooperate

CHICAGO—Approximately 35% of the local associations of the National Association of Master Plumbers are now cooperating with the gas utilities in their respective areas, declared J. J. Calnan, past president, National Association of Master Plumbers, before the American Gas Association Convention, held here October 14-18. There is an additional 10% who participate cooperatively in the installation of gas piping and appliances. This means that 65% of the local associations do not cooperate with gas utilities on selling, and 55% do not cooperate on installation.

New Seattle Dealer

SEATTLE—The Perfection Engineering Company has established a new air conditioning and heating business at the triangular intersection, 1624 Westlake Avenue. New air conditioning and heating equipment is featured and demonstrated in the new headquarters of the concern.

OBI Decides on Policies; Adopts Seal

NEW YORK—At a meeting of the board of directors of the Oil Burner Institute held at the Hotel Pennsylvania on October 8, the major policies of the Institute were adopted and final details of the program approved. The major policies were summed up as follows: "The increasing of public and 'private interest' demand for oil burning appliances through promoting an increasing acceptance of oil as a fuel."

At the same time the board adopted a seal for use of its members on equipment and in every form of advertising of their products. The seal will be

placed only on equipment manufactured by a member and offered for general sale under his established trade name.

A formal plan of cooperation was also concluded with the American Petroleum Industries Committee of the American Petroleum Institute for the expediting and providing of effective action in combating unfavorable or unfair legislation to oil burner appliance interests on a national basis.

Formal invitations to membership will be sent to domestic, industrial, and distillate burner manufacturers and invitations to associate membership will be issued to accessory manufacturers and the presidents of recognized dealer associations.

It was decided to hold the 12th National Oil Burner Show in Detroit April 14-18, 1936. M. F. Cotes will be chairman of the committee on the management of the show.

Yaglou Addresses Boston Group

BOSTON—The Massachusetts Chapter of the ASHVE opened its 1935-6 season October 15 at the Engineers' Club. Prof. C. P. Yaglou of the Harvard Medical School spoke on Study of Summer Cooling Standards. Professor Yaglou indicated that the currently accepted comfort zones are not necessarily synonymous with health zones and expressed the hope that studies might be continued with subjects whose reactions were less normal than students of college age on whom the studies were based.

As an illustration of the work to be done in developing health standards, Professor Yaglou outlined the experiments of Doctor Mills. These tests indicated that of several groups of rabbits subjected to a preliminary temperature treatment, those least able to withstand unusually high temperatures of 96°-100° were the group who had been alternately exposed to a temperature range of 88°-90° and 52°-60°. The groups conditioned continuously in each temperature range outlived the group exposed to each temperature in alternating periods.

Officers for the forthcoming year were announced as follows: president, W. A. McPherson; vice-president, Prof. James Holt; secretary, Grenville B. Gerrish; treasurer, Louis J. McMurrer; papers and meetings committee, Prof. Philip Drinker, chairman; membership committee, L. A. Brisette, chairman; social committee, Coll Flint, chairman.

Attic Fan Sales Up in Birmingham

BIRMINGHAM, ALA.—A steady increase in the demand for attic ventilating and exhaust fans here is reported by Louis E. Hoene, ventilating engineer, Birmingham Electric Company. He reports that where there were only 40 attic fans on the company's lines prior to 1935 that 35 such fans were sold during 1935. In addition 147 exhaust fans for commercial use were sold.

"As far as a prediction can be made at this time, probably not more than 25% of home-owners will at any time in the near future install air conditioning," said Mr. Hoene. "That leaves the other 75% as customers for attic fans." He reports that an installation was made in Birmingham this year in a house 42 years old and in another 36 years old.

The Birmingham Electric Company sells no fans itself, but cooperates closely with fan dealers. The estimate is that 150 attic fans for residential use and 250 exhaust fans for commercial use will be sold in Birmingham during 1936.

Denver Contractors Licensed

DENVER—An ordinance passed in May by the Denver city council requiring all heating contractors to have licenses to operate has finally gone into effect, with 27 applicants appearing to undergo examinations to obtain licenses.

Although the ordinance was passed months ago, a question of its validity has just been cleared, according to Joseph E. McNevin, secretary of the local Heating, Piping and Air Conditioning Contractors Association here. The law, brought about through the efforts of the general contractors of the city and the Colorado Construction League, requires applicants to pass examinations showing their fitness for the trade. The license, costing $10, may be procured in the name of a concern and apply to all its employes. An individual, working independently and alone, is required to have the same license.

The examinations, which are to be of a technical and theoretical nature, will be conducted by Harry Herman, registered licensed heating engineer, and two recognized heating contractors, Frank Cullyford and Paul E. Werner. All applicants must state their experience and the specific type of work they wish to do.

Although there are 80 contractors in the city, only 27 have applied for licenses thus far.

A move is on to pass a state law similar to that of the city of Denver.

Adsorption A.C. Described at Meeting

CHICAGO—The first meeting of the new season was held by the Illinois Chapter, ASHVE, at the Hotel Sherman, Chicago, October 14. The occasion was the annual meeting of the chapter and election of officers. J. H. Milliken was elected president, other officers being J. J. Hayes, vice-president, L. S. Ries, secretary, J. R. Vernon, treasurer.

Ernest Szekely gave a talk on Adsorbents Used in Air Conditioning. He discussed all types of adsorbents but gave particular attention to silica gel. In the discussion it was brought out that when silica gel was heated to 900° it reverts to sand.

Packaged Coal Sold in Grocery

BROOKLYN—Among the newer manufacturers of packaged coal is the Avers Fuel Corporation which sells 15-lb. "bricks" of Pocahontas coal. A feature in connection with its sale is a contract recently closed with a grocery chain whereby the latter will stock and sell the Avers packaged product over the counter precisely as it does regular grocery items.

SALESMAN FLIES TO WORK

Harry Turlington, flying salesman of Crane Company in Florida, makes the rounds of his territory by plane. From his territory has originated about 20% of all the FHA loans granted in Florida. Mr. Turlington is shown at the left.

56 Stokers Sold in Month

BIRMINGHAM—The 1935-36 selling season for coal stokers opened early in this city with 56 being sold for August, more than for all of last season. The August sales included eight commercial installations.

An FHA campaign in which eight dealers and the Birmingham Electric Company cooperated was conducted early in August. Ten men called on homes soliciting prospects for 30 days. This helped to give the dealers an early start. Cooperating dealers in this campaign were Clark & Jones, Flint Refrigeration Company, Kendrick Maytag Company, Pate Company, James Arthur Smith Company, Standard Roofing Company, and George F. Wheelock Company.

The Birmingham Electric Company is now engaged in a direct mail campaign for coal stokers. Prospects thus developed are divided among the dealers and in addition the utility assists in closing sales.

A. C. for Tobacco Firm

HENDERSON, KY.—Air conditioning for all-season operation has been installed in the new executive offices of the 75-year-old tobacco exporting firm of Charles T. W. Argue in Henderson, Ky. Equipment consists of a Servel air conditioning machine unit connected to a heavy duty, suspended type conditioner, from which the air is delivered by a duct system to five separate offices. Construction of the new offices was planned to provide for the air conditioning system, with special attention given to insulation work to reduce heat losses. The application includes provision for heating, cleaning, and humidifying during winter months.

New Chapter Requests Charter

WINNIPEG, MAN. — The Winnipeg members of the newly organized branch of the ASHVE, held an interesting meeting in the St. Regis Hotel here recently.

One of the features of the dinner hour was an address by Ernest Szekely, of Milwaukee, who spoke on Solid Adsorbents in Air Conditioning.

It was decided to petition the Society for a local chapter charter, and the necessary signatures were affixed to the application.

A.C. for Government Office

WASHINGTON—An air conditioning system is to be installed in the conference room of the new Department of Commerce Building here. The project will be under the supervision of the National Park Service, Department of the Interior. November 4 is the date for opening bids.

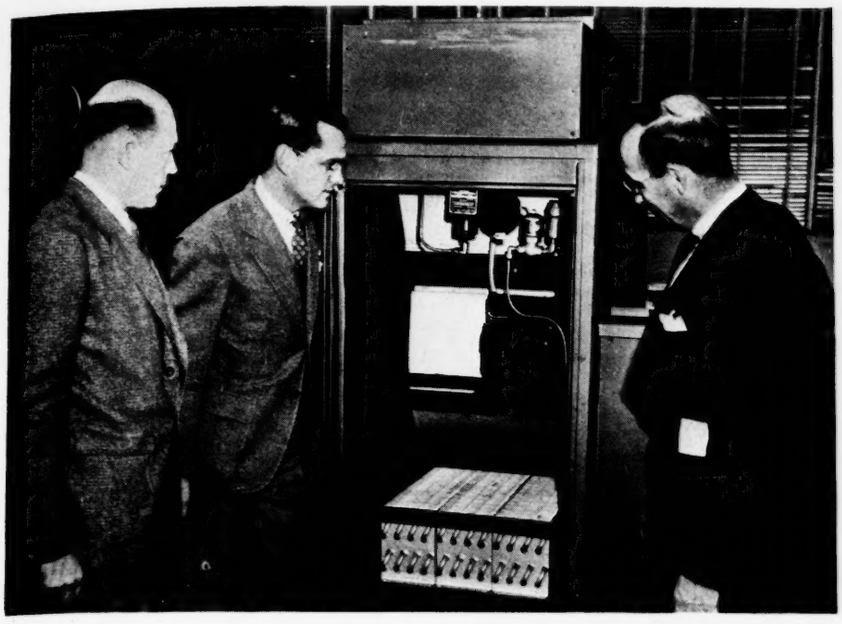
Baker and Vilter Join ACMA

WASHINGTON — The Vilter Manufacturing Co, Milwaukee, and the Baker Ice Machine Co., Inc., Omaha, are recent additions to the membership of the Air Conditioning Manufacturers' Association.

Manufacturers Adopt A.C. Standards

CHICAGO—At the October meeting of the Air Conditioning Manufacturers' Association, held at the Palmer House, standards for rating and testing air conditioning equipment were adopted. These standards are the result of many weeks of investigation and study by leading air conditioning engineers, representing not only the manufacturers but also the ASRE, and the ASHVE. Much of the uncertainty which has confronted buyers of air conditioning equipment is removed by this action of the manufacturers.

Consideration was given by the manufacturers to informing the public as to what true air conditioning is, what an air conditioning system should do, and approximately what air conditioning should cost on the basis of results to be obtained. The responsible manufacturers of air conditioning equipment will welcome the formulation and adoption of these standards, for this yardstick should go far toward maintaining the practices of the air conditioning industry on a high plane and should offer a substantial discouragement to those who would enter the field of air conditioning with the hope of quick profits at the expense of the consumer. There is little doubt that the public is generally bewildered and probably sometimes misled by the loose use of the term "air conditioning," and that situation must be clarified by the air conditioning industry itself.



A year 'round air conditioning system was announced late in October by B. E. Moyer, right, president of Airtemp, Inc., at a three-day convention of the company's distributors. Others in the photograph are Robert Bromberg, Birmingham, and Charles Phelps, Philadelphia.

Howatt Predicts Widespread A.C. of Schools

DETROIT—Current tendencies and future trends in the heating and ventilating field were covered at length by John Howatt, president of the ASHVE before sixty members of the Michigan Chapter at the first fall meeting, held here October 8. President A. C. Wallich, of the Universal Cooler Corporation, presided.

"It is necessary in these changing times to keep a weather eye on new developments affecting the heating and ventilating business," said Mr. Howatt, speaking on 'The Changing World.' "Science is the least fixed of all the arts. New developments are continually being introduced and will continue to be introduced, particularly in the field of air conditioning for comfort.

"The problem of the school system is a factor of this changing world that will bear watching. Schools suffered from the depression. Income decreased but the overhead load not only continued unabated but increased due to the larger number of students remaining in school because they cannot find work. Other businesses were able to reduce the load when the income dropped, but with the schools this was not possible. There are twenty millions of students in our schools and colleges today, the largest number in our history.

"Right now two millions of children are being denied an education because the school systems cannot absorb them without increasing facilities, and this work is hampered by lack of funds. School building plans were curtailed all over the country. In 1929 school construction totaled $392,000,000, in 1933 but $40,000,000, about 10% of the 1929 figure. The figure for 1934 was $115,000,000 and for 1935 will be about $125,000,000. The trend today is to more practical and less showy structures, yet providing ample facilities. More attention is being paid to the safety and security of the students.

"The present trend is to stress economy and efficiency, durability, and low upkeep cost. What the future trend will be no one can say. We know this much, however, the safety factor will be constantly increased and the sanitary and heating factors will be increasingly important. I believe that air conditioning of school buildings will be the next major tendency, so that efficiency can be maintained throughout the year."

COMING EVENTS

DECEMBER 5-6, 1935. *Eleventh Annual Conference on Welding, Purdue University, Lafayette, Ind.*

JANUARY 27-30, 1936. *National Warm Air Heating and Air Conditioning Association Convention, Hotel Stevens, Chicago, Ill.*

JANUARY 27-31, 1936. *Annual meeting of the American Society of Heating and Ventilating Engineers, Palmer House, Chicago, Ill.*

JANUARY 27-31, 1936. *Fourth International Heating and Ventilating Exposition, International Amphitheatre, Chicago, Ill.*

APRIL 14-18, 1936. *Twelfth National Oil Burner Show, Detroit, Mich.*

Airtemp Has Year 'Round Conditioner

DETROIT—A new year 'round air conditioning system that combines heating and cooling in one complete unit was announced here October 22 by Airtemp, Inc., a division of the Chrysler Corporation.

President B. E. Moyer of Airtemp made the announcement at a three-day convention of the company's distributors, held October 22-24. He said the equipment for the new system is in production and available for delivery.

"Functions of this year 'round system are many and varied," he said. "The one system heats and humidifies in the winter, cools and dehumidifies in warm weather and filters and circulates the air, and provides for proper ventilation all year long."

The new all-season conditioners are flexible and can be placed in any size home and can be adapted to hot water, steam, or vapor systems.

E. C. Chapman, vice-president and general manager of Airtemp, who also spoke before the convention, pointed to the marked increase in building permits during the past eight months as an indication of the market for the new conditioning system. He said the number of building permits issued in the United States every month this year shows a big gain over the corresponding month last year.

Distributors from key cities all over the country attended the convention, which was held in the new auditorium of the Chrysler engineering laboratories.

A.C. Bureau Hears Talk on Humidity

SPRINGFIELD, MASS.—The Air Conditioning Bureau of Springfield, meeting October 17 at the Building of Electrical Progress, heard A. J. Guffanti, vice-president, Springfield National Bank, speak on The Federal Housing Administration and its Relation to the Field of Air Conditioning. Thayer Francis, sales engineer, Parks-Cramer Company, spoke on winter conditions and stressed the effect of humidification in industry. He said that humidification was essential to industrial purposes. The talk was illustrated with lantern slides.

Frank Wyckoff, president of the bureau, presided at the meeting.

N. Y. Hotel Conditions Suite

NEW YORK—The Hotel Lexington has announced the recent installation of a year-'round air conditioning system in one of its guest room suites. Although the practice of air conditioning public rooms and dining rooms is well established among New York hotels, the Lexington claims to be the first in the city with air conditioned guest rooms.

Medical Aspects of A.C. Discussed

NEW YORK—The American nation is in danger of burning itself out, causing a mental and physical disintegration due to too great variations in climatic conditions which can be alleviated by a proper application of air conditioning and careful indoor temperature control, declared Dr. C. A. Mills, professor of experimental medicine, University of Cincinnati, at the opening meeting of the New York Chapter, A.S.H.V.E., October 21. Approximately 300 members and their guests turned out to hear Doctor Mills speak on the "Physiologic and Medical Aspects of Air Conditioning." A number of prominent physicians were the guests of the chapter.

Doctor Mills said that a study of the effects of climate on the human race shows that variations in temperature and other climatic conditions tend to stimulate people and in the northern part of the United States these variations are so extreme as to create the threatened danger of overstimulation.

It is possible, he continued, to control the environment and air conditions in which urban dwellers exist for at least 90% of the time in every day, and control of these conditions during that time may be able to do much in eliminating any ill effects from outdoor climate in which these people spend the other 10% of their time.

While the problem in the northern part of the United States is to prevent overstimulation due to too great a climatic variation, Doctor Mills asserted, there is a need for increased stimulation in the tropics and the gulf states of this country. Proper application of cooling through indoor air conditioning in these regions may make it possible to increase stimulation and the energy of the people to any desired degree, he said.

Human and animal development in tropical warmth is depressed and delayed markedly by the difficulty of heat loss from the human body, he continued. Growth is slow and vitality is low. Cooling through air conditioning offers the means of overcoming this handicap.

In tropical regions people lack sufficient energy to compete in the present day stress of economic life. Relief can be had there by cooling but such cooling needs to be done with great care because these people are sensitive to it. Their comfort zone is higher by several degrees than that of the people of the north. In other words, they chill more easily.

Boston NDHA Elects Officers

CAMBRIDGE, MASS.—At the October meeting of the Boston section, N.D.H.A., held at the Harvard Faculty Club, the following officers were elected: J. F. Treat, Pittsfield Electric Company, chairman; Raymond M. Nee, Edison Electric Illuminating Company, of Boston, vice-chairman; H. W. Frederick, Harvard University, treasurer; R. H. Kriesinger, Cambridge Electric Company, secretary; G. K. Saurwein, of Harvard, retiring chairman; D. E. Washburn, Boston Edison Company, L. K. Spink, the Foxboro Company, and E D. Learned, New England Power Company, directors.

At the afternoon session discussion of various papers read at the national convention was conducted by the following members: Present Methods of Office Records of Steam Use, Dale E. Washburn; Insurance Rates Committee report, Russell Hastings; Effect of Intensive Utilization Work, George A. Orrok, Jr.; Cell Concrete for Underground Construction, David H. Little; Distribution Committee report, Raymond Nee.

In the evening Prof. James Holt, of M.I.T., discussed Steam Jet Refrigeration; E. L. Root, Care and Treatment of Boilers When Laid Up; C. V. Fry, Cinder and Dust Elimination, and Cottrell Dust Collector, by C. E. Beaver.

Modine Unit Heater Contest is Big Success

RACINE—The Unit Heater Contest of Modine Manufacturing Company here brought hundreds of solutions to the problem. Entries came from the majority of the 48 states, several from Canada, and two from England. Company officials believe it to have been by far the most successful of any contest ever held in connection with the heating, ventilating, or air conditioning industry.

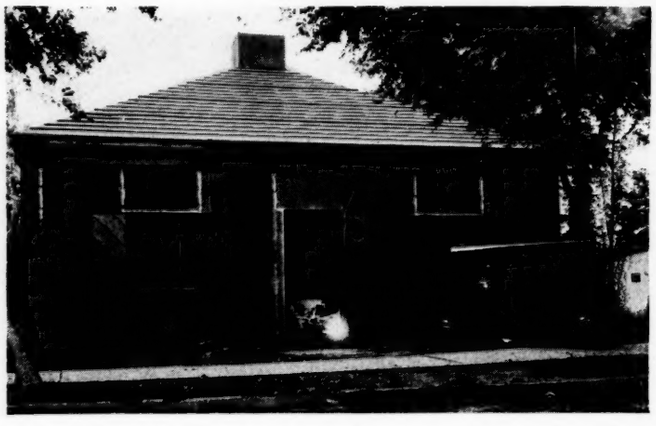
When the plan and conditions were published in August the number of solutions anticipated was placed at not over 200. Final results found this number substantially exceeded.

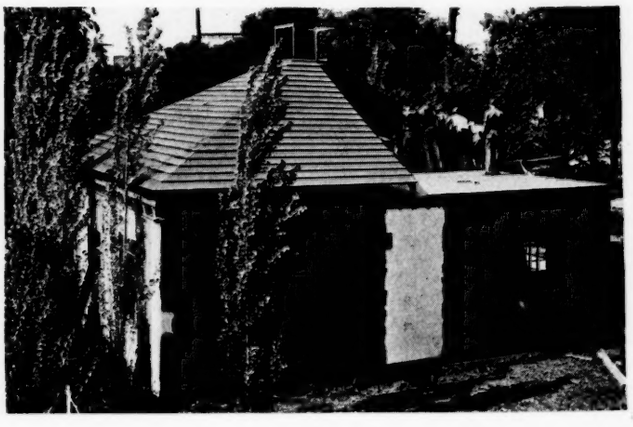
The large number of entries showed that the problem itself was both interesting and instructive. The solutions also produced a number of surprises, for, as A. G. Dixon, sales manager of Modine, states: "What we were not prepared for was to find that our friends submitting solutions are doing things with our own unit heaters that we had no thought of doing but that look like pretty sound applications nevertheless."

The high prize of $200 was by vote of the judges awarded to P. A. Edwards, G. F. Higgins Company, heating contractor, 608 Wabash Building, Pittsburgh. In the case of both the $25 prize and $10 prize additional awards had to be made because of ties in the judges' votes. The full list of awards appears on page 4 of this issue.

A.C. for Sears Store

CHICAGO—M. G. Harbula and Associates, consulting air conditioning engineers, have been retained by Sears, Roebuck & Company to air condition the Feibleman Department Store, Sears' five-story unit in New Orleans. This is the third commission awarded to Harbula by Sears within the last two years.





AN ARC-WELDED STEEL HOUSE

Not a single piece of wood is used in the construction of this new, modern all-steel home being erected by Hobart Bros., Troy, Ohio. View to the right shows the placing of roof sections which were prefabricated, placed into position and arc welded into one solid steel roof.

Avery Speaks at Buffalo

BUFFALO, N. Y.—The October dinner meeting of the Western New York Chapter, ASHVE, was held here October 14 at the Touraine Hotel. The speaker was L. T. Avery, of the Avery Engineering Co., Cleveland, who discussed Current Fallacies and Problems of Air Conditioning. He made particular reference to the apparent misuse of the term air conditioning in advertising and stressed the point that in his opinion it is absolutely necessary for the industry to set up standards for desired indoor air conditions under definite outdoor conditions.

One hundred and eight members and guests attended.

A. C. Courses in Philadelphia

PHILADELPHIA — The Spring Garden Institute has added a course in heating and ventilating to its list of evening courses. The course is practical rather than theoretical. Seventeen students are registered, many being heating and oil burner salesmen and mechanics and coming from points as far distant as Wilmington and Lancaster. This is a one-year certificate course, meeting for two hours, two nights per week, and is under the direction of Franklin W. Wandless.

Drexel Institute is offering a four-year diploma course in air conditioning this year. Drexel offered for the first time last year an evening course of one year in air conditioning, and the course was so popular that it has been continued this year, and the new course added.

Toronto Chapter Opens Season

TORONTO, ONT.—Forty members and guests of the Ontario Chapter, A.S H.-V.E., attended the dinner at the Weston Golf Club, following a spirited game of golf, to mark the opening of the 1935-36 season.

One of the features of the enjoyable banquet was an address by E. R. Gauley, who outlined in an interesting manner "The Scale Buoy." He was introduced by M. W. Shears, president.

President Shears was elected representative from the Ontario Chapter to the Nominating Committee, at the annual meeting of the society which is to be held in Chicago, in January. E. H. Gurney, member of the council of the chapter, urged that a real effort be made by the members to attend the annual meeting in Chicago. He also urged the members to have faith in the industry, stating that more advancement had been made since 1931 than had taken place in the former 20 years. The value of the exhibition of new products at the annual meeting was also regarded as something of distinct value to the air conditioning and ventilating contractor who believed in keeping up to date.

CORRESPONDENCE

Drug Drying

Editor:—I want to add a little comment to the article in your October number entitled "Dehumidifying an Industrial Plant Aids Process," author's name not given. He bases his article on the fact that "many drugs and chemicals are extremely sensitive to temperature and moisture changes." He deals with those which have to be dehumidified for manufacturing purposes.

A bit of history that is not generally known, may be of interest in this connection. At the time of the close of the Civil War, the writer's father, Mr. A. K. Campbell, then of Newton, Ia., operated a drug store and among the items which he carried in stock was opium. But on account of the war it was extremely high in price. He noticed that after he got the opium in and opened it up, it shrunk in weight and he began to study and investigate the reason why. He reached the conclusion of course, that it was due to loss of moisture, a thing that we would, of course, know these days without thought, but a line of thought which was entirely new at that time. It was this beginning which started his interest in problems of heating and air conditioning. He later combined with it the idea of recirculation in connection with warm air furnace heating. At that time all such heating was done entirely with outside air.

He put these two ideas into the form of patents, one in 1880 and another in 1883.

I can still remember hearing, as a boy, the hot arguments over recirculation which now is taken for granted under most heating conditions.

This is just a bit of history that may prove interesting.

E. K. CAMPBELL

E K. Campbell Heating Co.,
Kansas City, Mo.

Comments from Buenos Aires

Editor:—The June issue of your journal is interesting and merits congratulations. It also excites one to questions. So if it is not too much trouble, will you reply, even though briefly, to the following?

Page 25 refers to the electrical cleaning of air. Is this based on the Cottrell idea? We are sometimes forced to put in very large filters for sooty sites, and if 97% can be eliminated by an electrostatic cleaner, we and our customers would be the gainers. Is such equipment on the market?[1]

On the same page, the percentages of iron dust, oil, and other impurities are interesting because quite unexpected. What becomes of the iron that gets into the mechanics who work in shops all their lives? Does the autopsy show it as little briquettes in the lungs?[2]

Page 41 information on warm air heating is curious and of interest. Here, either radiators are used, or hot air is injected near the floor level, with no recirculation. In the case of radiators, only infiltration air provides renewal. Warm air one-way injection is 100% replacement fresh air. There are but two or three modern buildings of steel in the city, everything new being of reinforced concrete, the record being a 33-floor apartment house, air conditioned throughout by Carrier. (Compare this with your July issue, page 21.)

Horizontal ducts in reinforced concrete buildings, where appearances count, are practically inadmissible. Beams run in both directions. Partition walls are built up to these beams. Horizontal ducts would therefore reduce the clear height of the rooms, and as a minimum is stipulated by the city building code, the building itself would be increased in height a distance equal to the sum of the duct heights on all floors. The exception to this is that false ceilings may be placed in halls, but the beams are still in the way.

Ducts are therefore all vertical, enough being provided to reach all rooms on all floors, the same ducts being used in summer and winter. There is a hinged door at each opening, which can be set to a maximum by the janitor and which is adjustable by the tenant.

The explanation of thermal precipitation of dust (page 42), if correct, explains why radiators soil the walls more than injected warm air.

On page 48 the Resolution 7 makes interesting reading to us who are far enough away to consider it disinterestedly. It reminds me of the resolutions of the Western Federation of Miners of 40 years ago—worth trying. If enough of you get together back of this resolution, and not enough get together to oppose it . . . . . Almost anything ought to be possible during this administration, where only votes count, and from which Mr. Roosevelt will resign before his term is out. Whatever law or ruling or regulation helps me and hinders my competitors, gets my support. Whatever trade or industry I am in, should be tightly closed against outsiders, whether it be architecture, medicine, potatoes, or politics.

[1]Not generally, we believe. Applied in a limited fashion. Idea is apparently similar to Cottrell in that electrical precipitation is used.—*Editor*

[2]No information as to iron, but studies indicate that some industrial dusts actually do collect in the air passages and lungs in measurable quantities.

Mine air conditioning described on page 53 is interesting. The plant put in by Mr. Davies at Morro Velho is a combination of ammonia at the surface with a Carrier plant on a lower level. The mine is now so deep that something more must be done soon. The Carrier plant cooling water is cooled by using the up-cast air in a spray chamber. The evaporative capacity of the air available for this purpose is fully taken up, so that if another unit is placed on still lower levels, more air will have to be dried at the surface.

The cross section of the mine openings is of course reduced as depth is attained with the result that the 60,000 c.f.m. at the surface becomes a gale through the restricted openings at the bottom of the mine. The rock is too hot to touch—drill steel must be handled with gloves—the men work stripped to the waist and on very short shifts. Surface seepage water is picked up as near the surface as possible and there is of course no provision for laying dust. The result is that in dead-end cross-cuts, rises and stopes where air drills are used, the dust is so dense, you can lean against it.

Your page 54 is worth a year's subscription—more Who makes these heat interchangers?[3] We could use a quantity of them as after-coolers on adsorption plants. For example, 3000 c.f.m. at 60° C. to as near 30° C. as possible with 30° C. air. If we cannot buy, will have to develop, but developing costs money.

The data, page 54, on classroom odors makes us think. We have not been able to eliminate these odors with refrigeration plants since washing has no effect, but either of the adsorbers in common use will eliminate completely these and other much stronger odors. Air taken from above cooking onions and cabbage and air containing ammonia leave the adsorber completely free from odor, so far as one's nose knows. So if 2 c.f.m. of fresh air per person is sufficient so far as oxygen content is concerned, then the load on an adsorption conditioning plant can be much reduced, as compared with present practice.

And this brings up another point which you may be able to explain for us. Refrigeration conditioning plants all have automatic controls on the fresh air inlets. This means varying quantity of fresh air. Hot, humid days—less fresh air? Then why supply *more* fresh air on *cooler, dry* days?[4]

In this market, the fight is on between the burner for Nos. 2, 3, and 4 fuel oil, and the burner which can handle mixtures of these with up to 80% of cracked-residue fuel. The latter makes slag, but also saving.

We should like to know about the Shepard[5] burner and to have a distillation analysis of No. 6 oil.[6]

The expression "highly nebulous" (page 50) is delightful. When the industry gets to be perfectly honest with itself, every conditioning company will have one old, old man with lots of experience, to determine the "final factor."

On page 50, July issue, is a paragraph which perhaps should be elaborated or limited. Suppose that someone had told Pasteur or Lister that "bacterial contamination occasionally presents a problem in bandage cleaning." You know that in those days they used the same bandages over and over again with occasional and casual cleaning—as the present-day surgeon uses the air in his operating room over and over but *without* the occasional cleaning.

Some extremely interesting experiments have been made here by a surgeon in his operating room. He has a small air conditioning unit which gives him comfort in the hottest weather. Also, he can get plenty of colonies, as varied as the people in a West Side tenement, on a culture medium exposed in the room for one minute. The surgeon complains that after going to all the trouble of boiling everything in the room, including his hands and the nurses', he must use contaminated air. He is going to do something about it. Will he be the first to do it? Will it mean heating *all* of the air to above 100° C.?[7]

The "optional" article on page 28 describes an interesting plant. Another which has been put in in Buenos Aires is also a central system, but with ducts supplying conditioned air summer and winter to all rooms and under control for tenants who do or do not want to pay for conditioning.

The Construction League suggestions on page 40 read like a translation of a Soviet regulation.

To use the expression "changes per hour" in our company (your page 52) is tantamount to resigning!

We would like to know about that Ridgid Tubing Cutter.[8]

(This machine is not used to working in a Spanish speaking country, so please excuse mistakes.)

MARK R. LAMB

New York Steel Exchange,
Buenos Aires, Argentina.

[3]Available from a German firm.
[4]Discussion is invited.—*Editor*

[5]Shepard burner (Shepard Heating Equipment Corp., Brooklyn, N. Y.).
[6]Distillation tests are not generally applied to oils heavier than No. 3, because of cracking which starts at about 650° F. No distillation test of No. 6 oil available.

[7]See page 27, October, 1935, HEATING & VENTILATING on use of ultra violet rays for destroying bacteria in hospital air.
[8]See July, 1935, HEATING & VENTILATING, page 70.

WITH THE MANUFACTURERS

The Automatic Products Co., Milwaukee, Wis., manufacturer of automatic controls has added 5,000 sq. ft. of floor space to its manufacturing plant. This is in addition to the 3,500 sq. ft. added last spring which increased the general offices and engineering department.

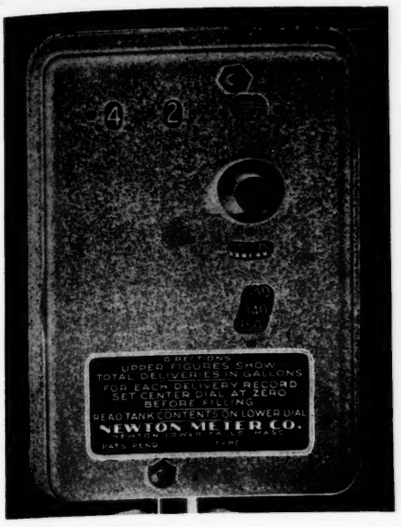
General Electric Co., Air Conditioning Dept., Bloomfield, N. J., has appointed E. J. Opal formerly manager of the merchandising division, as manager of the gas furnace and air circulator division, to devote his full time to the marketing of those products. The merchandising division has been discontinued, and E. B. Shiddell, its former assistant manager, has been appointed assistant to the manager of the air conditioning department, in charge of dealer operations. A. C. Roy, advertising and sales promotion manager, will also serve as chairman of the sales committee. R. U. Berry has been placed in charge of special applications. H. E. Perkins, manager of the Bloomfield works, has been appointed a member of the product committee and chairman of the manufacturing committee. The consolidation of the department, started in July when divisions of the company in New York and other eastern cities were moved to Bloomfield, was recently completed when 50 additional members of the department were transferred to the New Jersey plant from headquarters in Schenectady.

The Insulite Co., 1100 Builders Exchange Building, Minneapolis, Minn., has appointed George A. Petters, as sales engineer at Chicago. Mr. Petters is a graduate of Armour Institute of Technology and for several years has been engaged in construction activities in the middle west. He will make his office at 111 West Washington St., Chicago.

Kelvinator Corp., Detroit, Mich., has appointed John S. Garceau as advertising and sales promotion manager according to Sam C. Mitchell, director of the company's advertising and sales promotion. Mr. Garceau will have charge of advertising and sales promotion for air conditioning and automatic heating equipment. He has been with Kelvinator since 1927.

Niagara Blower Co., 673 Ontario St., Buffalo, N. Y., has appointed John R. Cooper as New York manager of its unit heater department. Mr. Cooper was formerly sales manager for Thermal Units Manufacturing Company, Chicago.

NEW EQUIPMENT



Newton Fuel Oil Meter

A tamper-proof meter for domestic fuel oil tanks has been placed on the market by the Newton Meter Co., Newton Lower Falls, Mass. It has a series of dials which show total deliveries of oil in gallons to date, the number of gallons put into the tank at each delivery, and contents of the tank at all times. The owner can easily compute the number of gallons consumed daily, or on any specific date, from the dial reading, and know exactly how much oil was delivered at any given delivery, as well as figure his costs for any specific period of time.

It is made in several models for high tank flat installation, for the high wide tank wall or vertical installation, and others of the 275-gal. obround styles. It is also made for different types and sizes of tanks used in other parts of the country. It is provided with a key which locks the intake dials, so that should an owner be away, or the delivery truck driver be unable to call the householder, the meter still stands guard over the fuel supply, and furnishes a reading of the amount delivered at that time, this reading acting as a check against the driver's delivery slip and the subsequent bill.

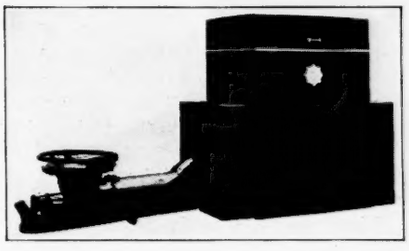
The meter consists of a sealed steel box with ratcheted dials and a system of pawls which work in only one direction when oil is being drawn, but can work in the opposite direction when oil is being run in, throwing the delivery dial in the opposite direction to register inflowing oil. When the owner locks the meter, he sets the delivery dial back to zero, and the delivery register starts from that point.

In the tank are two heavy wooden floats, painted with an oilproof paint, hanging by swivel chains at each end, one float below the other. As oil is withdrawn the lower float pulls down the upper, which acts on the dial. When oil is flowed in, the lower float has no action and the upper one gradually rises to pull the indicator of the inflow dial around, the lower float then acting to offset waves on the surface of the inflowing oil. The meter is so adjusted that the dials will not move for at least 24 hr. after any oil delivery, thus allowing a check whether the customer is present or not.

Link-Belt Anthracite Stoker

Link-Belt Co., Chicago, has added a household anthracite automatic stoker to its line of bituminous coal burners.

Three sizes are available, with maximum coal feeds of 25, 35, and 50 lb. per hr. It is said that performance and operating economy have been



thoroughly checked by many installations in service for at least two heating seasons.

Further information is available from the company's Philadelphia plant at 2045 West Hunting Park Avenue, or from the Chicago plant at 2410 West 18 Street.

Phillips Recessed Head Self-Centering Screws and Bolts

American Screw Co., Providence, R. I., is introducing a line of case-hardened sheet metal screws with a recessed, self-centering head.

In this head, a tapered recess, which exactly fits a tapered driver, takes the place of the slot in the conventional screw. This improvement enables faster driving with less effort and provides better holding power.

Used for joining sheet metal and making fastenings to sheet metal, the screw holds on the point of the driver, and may be brought into position with one hand, of importance when driving in hard-to-get-at places. The self-centering feature prevents the driver from slipping sideways. Less than half the pressure is required; the driver guides the screw, and the screw may be set up tighter with no danger of the head breaking.

Four sizes of Phillips drivers or bits are necessary to drive the entire range of screw sizes, and two sizes of drivers fit the range of sizes most commonly used. Bits are available for all power or manual drivers.

Kelvinator Oil Burning Boilers

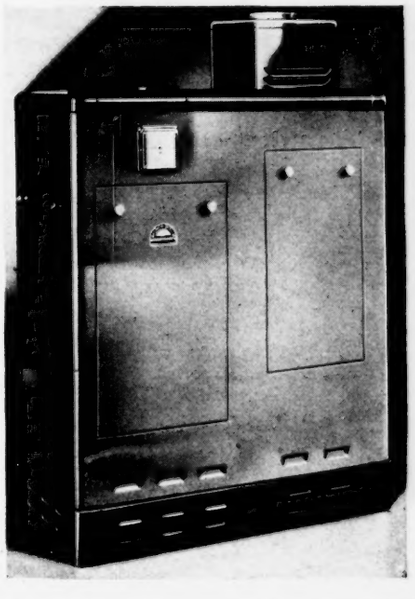
Three new oil burning boiler units have been added to the line of the Kelvinator Corp., Detroit. The units can be used for steam, vapor, or hot water systems, each unit combining a sectional cast iron oil burning boiler, water heater, and automatic controls.

Designated as models KB-3, KB-4, and KB-5, the units have capacities of 780, 1230, and 1635 sq. ft. of steam, respectively.

The mechanism and boiler of the units are enclosed in a bonderized steel jacket, insulated with highly efficient asbestos board and finished in grey enamel trimmed with bright chromium.

Bastian-Morley Gas Boiler

Bastian-Morley Co., Laporte, Ind., has introduced the series 25 Basmor gas fired boiler in which all controls are enclosed. The new housing is available with all series 25 boilers in steam, hot water, or vapor type, in all sizes from 3 to 11 sections, handling from 141 to 712 ft. of actual water radiation. The boiler illustrated is the 25-S-6 with an AGA rating of 550 sq. ft. of steam and capable of handling a net load of 350 sq. ft. It is 16½ in. wide, 40 in. long, and 48½ in. high, including draft hood.



Williams Air-O-Matic Air Conditioning System

The Williams Oil-O-Matic Heating Corp., Bloomington, Ill., has announced a year 'round air conditioning system known as Air-O-Matic. Low pressure steam, provided by an Oil-O-Matic oil burner, is supplied directly to a copper-finned heating coil within the central air distributing unit for heating service, which can be supplemented by direct radiators if desired. Provision for the addition of moisture is provided for winter heating service.

This same low pressure steam, through an absorption refrigeration unit, provides cooling for summer. A change from winter to summer operation can be effected almost instantaneously by means of a master control located in a suitable place.

The low pressure steam absorption unit, the feature of the equipment, has both a solvent and refrigerant of newly-developed chemicals said to be non-toxic, non-inflammable, and non-corrosive to the common metals and chemically stable under operating conditions.

Steam requirements for one ton of refrigeration are 19 lb. per hr. at a pressure of 10 to 12 lb. gauge. Electrical requirements for one ton of refrigeration are 75 to 100 watt hr. per hr.

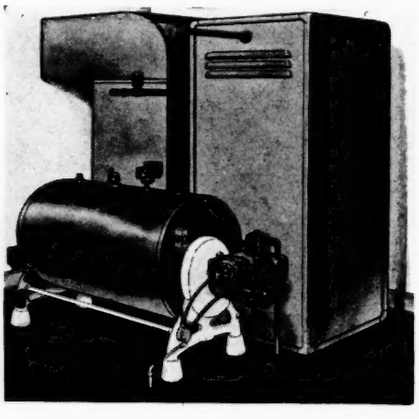
Single phase current can be used in the smaller installations. For all sizes of machines any low pressure steam boiler of the proper capacity may serve to generate the required steam.

The only metal-to-metal contact of moving parts within the refrigeration unit is between the seal face and seal seat of the solution circulating pump. This seal face operates in a bath of oil. The maximum pressure against this seal face is 45 lb.

In normal operation the pressure on the low side of the unit is between 8 in. and 2 in. of vacuum and the pressure on the high side is between 22 lb. and 28 lb. gauge. The heat dissipated from the refrigeration unit is four hundred and sixty-five B.t.u. per min. per ton.

The refrigeration units are rated on the basis of a 40° saturated refrigerant temperature in the cooling coil with a water temperature entering the absorber of 85° and a water temperature leaving the condenser of 95°. A 5° decrease in water temperature increases the capacity 11% and a 5° increase in water temperature decreases the capacity 9%. An increase of 5° in the temperature of the saturated refrigerant in the cooling coil increases the capacity 10%. Independent of the change in capacity of the unit due to change in cooling water temperature or saturated refrigerant temperature in the cooling coil, the steam requirements are 19 lb. of steam per hour per ton.

A four-ton refrigeration unit is 48 in. long, 19 in. wide, and 65 in. high, and the 20-ton unit is 70 in. long, 69 in. wide, and 60 in. high. Seven different sized units ranging in capacity from 4 to 35 tons are available.



Penn Stoker Combustion Control

Penn Electric Switch Co., Des Moines, Ia., has announced the addition of a timed interval, single unit combustion control for stokers. This control, the Penn type 550, is rated for ½ hp. single phase 110 volt a.c. service, sufficient to handle directly most domestic and semi-commercial stoker installations. It also may be used as a pilot control for stokers rated in excess of the rating of this switch.

The control incorporates a transformer which supplies low voltage to the control circuits, a synchronous electric timer and a relay. The synchronous electric timer automatically restarts upon return of current following current failure.

The control is wired so that the timer operates in conjunction with the room temperature control to maintain combustion without materially affecting room temperatures and without unnecessary fuel consumption, regardless of outside weather conditions.

This control is a complete combustion control device in one unit, which may be mounted anywhere for wiring convenience. It is not dependent upon stack temperatures for its operation.

Vermiculite Refractories

Vermiculite Refractories Co., 137 East 8 St., St. Paul, Minn., a subsidiary of Lewis Air Conditioner Company, is marketing a line of combustion chambers for oil burner installations. These are so constructed that a pear-shaped chamber of any size may be built up within a heater by the use of standard sidewall forms and standard ports. The chambers are made of Vermiculite refractory, a feature of which is said to be sound absorption. The forms are easily cut but become extremely hard after being subjected to heat. The weight of this material is about one-half that of firebrick.

De Luxe Unit Ventilator

B. F. Sturtevant Co., Inc., Hyde Park, Boston, Mass., is marketing the De-Luxe unit ventilator which has rounded end sections which completely enclose the steam, return, control, and electric connections. This affords protection against accidental contact with hot steam pipes, as well as giving the cabinet a modern appearance. The cabinet is trimmed with solid stainless steel. The enamel is baked-on in any solid color in either rough or smooth finish.

Penn Pump Controls

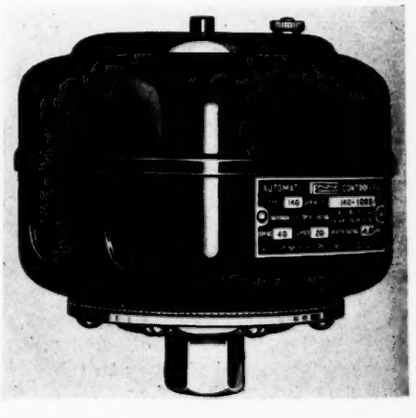
Penn Electric Switch Co., Des Moines, Ia., has introduced two controls for pump and air compressor service up to 80 lb. maximum pressure. These are known as type 140 and type 142.

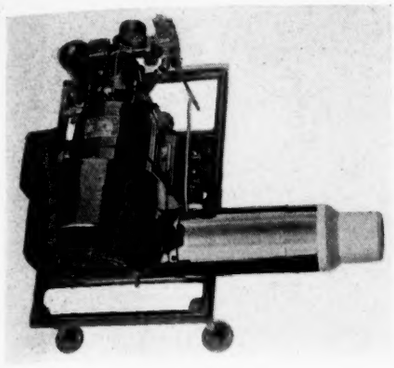
These switches are regularly provided tapped for ¼-in. standard pipe thread pressure connection, but are available in ⅛- or ⅜-in. tapped connection when specified. Both are double pole, double break switches.

Type 140 incorporates bimetal overload protection with trip-free reset button. With the bimetal overload mechanism, the switch is said to give sure protection against burned out motors even after the overload has tripped out innumerable times.

Pump and air compressor manufacturers and dealers have had the experience of users of their equipment blocking the reset device in reset position in order to hold the contacts closed and keep the unit running, without correcting the cause of the overload condition. Burned out motors result under these conditions. The type 140 switch is equipped with a trip-free reset button. When this button is depressed to reset the trip-out mechanism, the contacts are blocked open and held in open position until the button is released. Thus a user cannot block the contacts closed in any manner.

The same construction is found in the type 142 switch except that it is not equipped with the overload mechanism. Both are snap acting.





Kamy Oil Burner

Kraemer & Meyer, 239 Baldwin St., Bloomfield, N. J., is marketing the Kamy oil burner. This burner is of the pressure atomizing type equipped with a feature called the Adjust-O-Whirl.

In a large diameter air tube are several air diffusers, adjustable air diffuser blades and a whirling chamber. At the end of the tube is a smaller diameter combustion head. The feature of this design is that it produces a uniform flow of turbulating air. The whirling pitch of this air can be adjusted, which in turn will change the shape of the flame independent of the amount of oil or air used. The flame may be changed from a ball shape to a long and narrow shape, and can be adjusted to burn free from the firebrick or water mantle of the boiler.

Another feature is the mounting of the burner to the base plate, which consists of heavy felt and springs, reducing vibration and noise. A slow speed motor of 1150 r.p.m. is another feature.

The burner is available in the standard and de luxe models. The de luxe model has a larger base plate, a cover of attractive design, which entirely covers the unit, and a burner-mounted safety control.

Sarco Graduator System

Sarco Co., Inc., 183 Madison Ave., New York, has placed on the market the Sarco Graduator system for the control of steam heating systems of large buildings. It is a mechanical system of fully automatic control, directed by the weather, and can be applied to existing two-pipe steam heating systems of all types.

Two thermostats, one outside, the other inside the building, are employed to regulate the steam supply in accordance with the heat loss of the building. Automatic graduators are placed at the inlet of each radiator to assure uniform distribution of steam to all parts of the system.

A sealed tank, filled with air, serves as the outdoor thermostat and is connected to the main steam supply valve by copper tubing. This valve is the heart of the system and is shown in accompanying photograph of a section of this valve. An increase in the outside air temperature expands the air in the tank and puts a pressure on the bellows (2) of the main steam valve. This pressure pushes the valve stem (3) upward tending to close the valve.

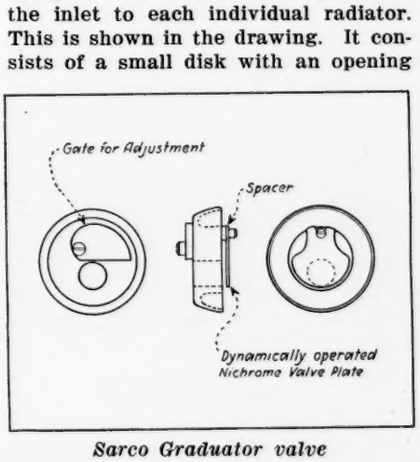
Attached to the valve inlet is a venturi tube (4) which is proportioned to provide a definite steam velocity to the valve. A pitot tube (5) inserted in the throat of the tube (4) receives the impact pressure of the steam and conveys it to the inside of the auxiliary bellows (6).

The outside of this bellows is acted on by the static pressure of the steam so that the action of the bellows is dependent on the net velocity head, or in other words the volume of steam flowing. A bellows (6) is attached to the valve stem (3) and assists the outside thermostat in actuating the valve.

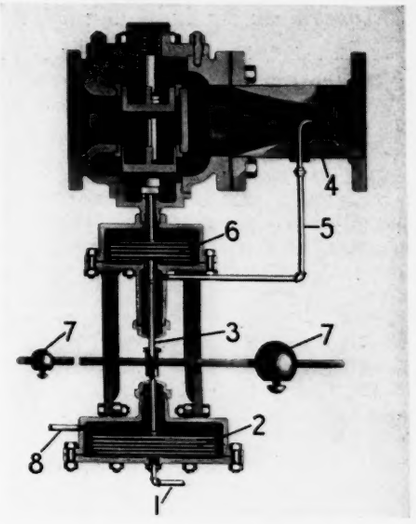
By means of the weights (7) the amount of valve travel is adjusted to suit local conditions, to enable the valve to balance itself at a point between open and closed, so that just sufficient steam will be admitted to the system to maintain the desired room temperature.

To prevent overheating, a provision is made for closing the valve automatically, at any time when the building is warm enough, although the outside thermostat may call for heat. A copper tube (8) is run from the main bellows chamber to a small thermostatic air valve installed on the wall in a key room of the building. Normally the valve is open, so that atmospheric pressure exists outside bellows (2). A connection is made also from the tube (8) into the vacuum return main of the system. Closing the air valve when the key room is up to temperature, causes a vacuum to form outside of bellows (2), which expands fully and closes the valve. In the case of a gravity system, an ejector is provided to create the necessary vacuum.

An essential part of the system is the graduator valve which is placed in the inlet to each individual radiator. This is shown in the drawing. It consists of a small disk with an opening



Sarco Graduator valve



Sarco main steam supply valve

in it. A small flexible plate is mounted at a fixed distance in back of the opening. This distance determines the amount of steam admitted to the radiator at minimum steam velocity. When the steam flow increases, the plate bends outward, thus increasing the opening. The result is said to be a proportionate increase in the flow of steam to the radiator.

An adjustable gate on the inlet side of the graduator permits the adjustment of the initial opening to provide for a simultaneous flow of steam to all radiators, regardless of their distance from the steam supply.

Airmixt Sally Mander

F. C. Williams Inc., 22805-9 Michigan Ave., Dearborn, Mich., is marketing a line of portable heating units designated the Airmixt Sally Mander, designed for industrial and semi-industrial and similar heating applications where a portable heater is required.

The unit burns coke and has a magazine which holds 4 cu. ft., or 100 lb., of this fuel. The unit is of the warm air type and is equipped with a fan with an outlet grille in the front of the unit. The fuel burning rate can be set and controlled with an indicating handle located on the rear of the unit.

The frame is built of angle section and electrically welded throughout. The outer panels are made of light gauge steel with slip joints at corners for easy removal. The standard finish is bright red enamel with black trim.

The unit is 24 in. wide, 48 in. long, and 37 in. high, and weighs approximately 500 lb. The fan has a capacity of 64,000 cu. ft. per hr., and is driven by a ¼-hp. motor. The heat output averages 250,000 B.t.u. per hr.

The unit can be supplied with a snow melting hood and has applications in heating unfinished buildings, warming airplane motors, and similar uses.

Adsco Packless Expansion Joint

American District Steam Co., North Tonawanda, N. Y., is placing on the market a packless expansion joint known as the U-ring type.

The expansion element is a series of die-formed U-rings of stainless alloy steel, welded together without transverse seams. One end is welded to the wrought steel body of the joint and the opposite end is welded to a plate that is in turn welded to the sleeve.

The joint is installed with the expansion element compressed, so that under actual operating conditions the element is in a neutral or normal position. Control rings and stop-bolts are said to distribute the expansion and contraction movement equally through the U-rings.

The joint is guided at three points to permit the sleeve to move freely. It is made with a wrought steel body which encloses the expansion element.

The joint is available for pressures to 400 lb. and temperatures to 800°, with flanged ends or beveled ends for welding directly into the pipe line and with or without anchor base.

Any reasonable amount of traverse can be provided, with a normal range of 1 in. to 8 in.

Self-Cleaning Spray Nozzle

A spray nozzle designed for humidification use, or for any place where spray with low viscous liquids is required, has been developed by the Rega Manufacturing Co., 79 Mt. Hope Ave., Rochester, N. Y.

The nozzle operates on pressure of 35 lb. or more and produces a fine spray. It passes approximately 6 qt. per hr. through the nozzle.

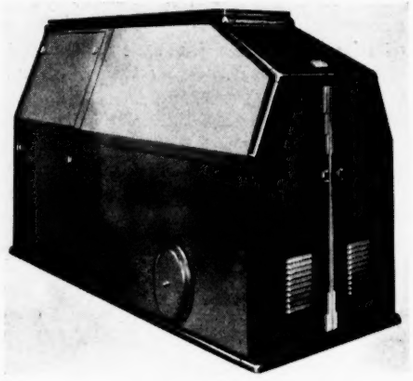
The orifice is automatically cleaned each time the water is shut off. This is accomplished by means of a spring action piston in the end of which is the orifice, and a cleaning pin. The piston moves forward when the water is turned on and returns to its orginal position by spring action when water pressure is released, forcing the cleaning pin into the orifice.

The nozzle can also be furnished to impinge a fine stream on a baffle plate, operating on a pressure of 25 lb. or more.

Dole Vari-Vent

Dole Valve Co., Chicago, has announced a variable vent valve for one pipe steam heating systems designated as the "Vari-Vent."

The valve is equipped with a needle valve vent construction which allows infinite regulation between fixed limits. This needle valve, raised or lowered throughout the limit of adjustment, provides variable openings for the release of air from the radiators in order to balance all the radiators in the system.



Model 102 Gar Wood Tempered-Aire

Gar Wood Industries, Inc., Detroit, announces a small Tempered-Aire unit, model 102, developed for homes of six or seven rooms. It is constructed with blower cabinet and furnace as one compact unit which will occupy a minimum of space. The pressure atomizing type burner uses no. 3 oil, yet free from all smoke to preclude any possibility of sooting.

The advantages of the larger models in the Tempered-Aire line have been retained. The unit supplies filtered, humidified and circulated warm air.

American Home Stoker

American Home Stoker Co., Builders Exchange Bldg., Cleveland, has introduced a low priced water operated coal stoker. It is said to retail at about half the price of most home stokers. Only a water connection is required and its operating cost is but a few cents a month. Rural water pressure systems make it available for country as well as city installations. Counting three springs and a hydraulic diaphragm it has only nine moving parts. Simultaneous control of the inlet and outlet water is accomplished by flapper valve mechanism closely corresponding to the operation of an automobile vacuum tank.

A piston moving ¾ in. each stroke delivers a quarter pound of coal at a stroke. The speed of stroking can be regulated as frequently as once a minute or as infrequently as once in twenty minutes.

Installation is said to be inexpensive and requires no alteration of the furnace. Firing through the regular fire door opening, the fuel is preheated and then discharged on a cone or sloping angle of repose.

Fedders Unit Heaters

Fedders Manufacturing Co., Buffalo, has added seven sizes to its line of series 3 unit heaters, making 20 standard models in the line. The addition of these provides sizes and capacities up to 1300 sq. ft.

Lewis Air Conditioners

Lewis Air Conditioners, Inc., 1600 Northeast Broadway, Minneapolis, Minn., has introduced the H-2 and GC series air conditioning equipment.

The H-2 unit is a room type conditioner which includes a heating coil, a spray head for humidifying, and an air filter and motor driven fan. It can also be used for cooling if deep well or cold city water is available. This unit is similar to the company's de luxe H-1 model, but is of smaller capacity and designed for the smaller homes up to nine rooms. In connection with a steam system, it has a heating capacity of 67.7 sq. ft. of radiator and the humidifier has an evaporative capacity of 1¾ gal.; with 180° hot water it has a capacity of 42.8 sq. ft. water radiator and an evaporative capacity of 1½ gal. The controls include a Humitrol, solenoid valve, and heat limit switch. It is furnished in a metal cabinet with natural wood finish; weighs approximately 125 lb.; is 33 in. wide, 31⅜ in. high, and 10⅜ in. deep.

The GC series units are of the warm air conversion type for converting gravity warm air furnaces. They include means of filtering, humidifying, and circulating the air. They are available in three sizes with air capacities of 1,000, 1,750 and 2,500 c.f.m.

A spray humidifier with automatic controls is a feature of the GC units.

Warm Air Control Set

Automatic Products Co., 121 North Broadway, Milwaukee, Wis., is marketing a warm air control set consisting of thermostat, motor, limit control, transformer, and necessary accessories. The motor is of dustproof construction while the thermostat has a range from 55° to 85°. The limit control is of the bonnet type.

The accessory kit contains 30 ft. of three conductor cable, 20 ft. of two conductor cable, 24 ft. of furnace chain, 25 ft. of cable wire, 5 pulleys, and staples and snap links.

Orders of three control sets from one customer entitles the customer to one set mounted on a display board completely wired and ready for demonstration.

Trane Air-O-Lizer

The Trane Co., La Crosse, Wis., has introduced its 1936 model of the Air-O-Lizer, a schoolroom air conditioning unit. Among its features are directional flow grilles. With these it is possible to direct the heated air into the room in any desired direction so that intervening windows and bare wall spaces may be blanketed with a curtain of heat.

The unit has other features such as ventilated pipe spaces to prevent freezing; one-piece lightweight balanced aluminum dampers, and multiple fans.

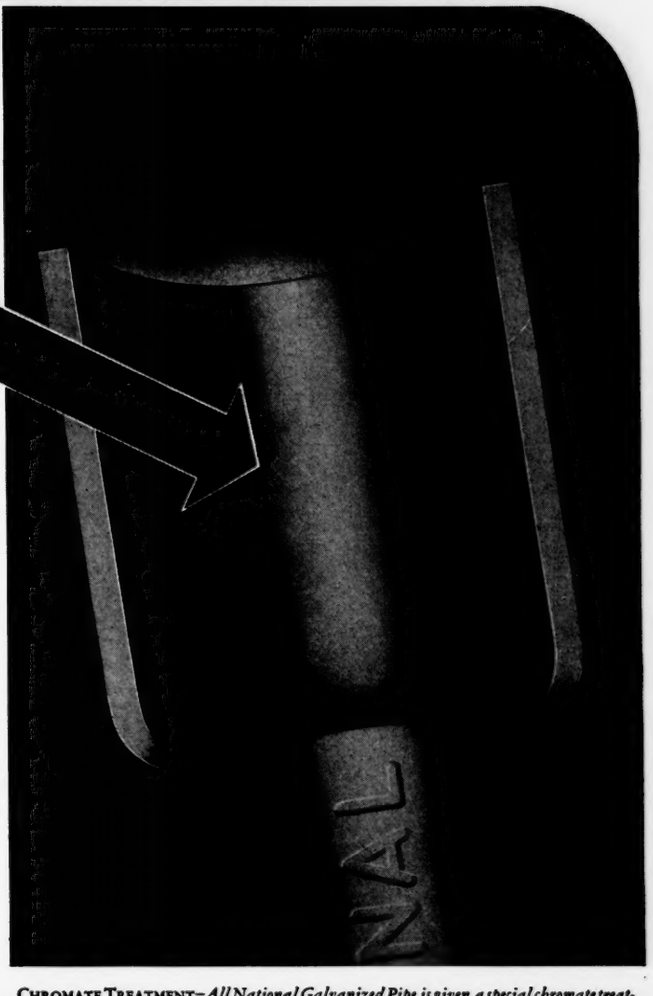
THE RIGHT START FOR A SUCCESSFUL PIPING SYSTEM....

...start with smooth, clean, scale free pipe

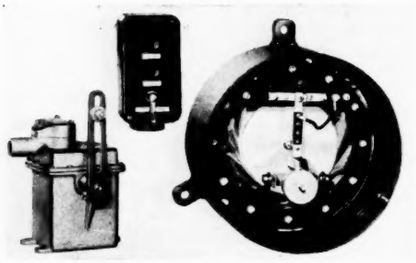
The foundation of successful performance in a piping system lies first, in the intelligent selection of the pipe—second, in good, sound installation practice. It costs no more to use pipe that will assure better performance and greater economy in the long run—pipe that has real practical "plus" qualities, such as the NATIONAL Scale Free and Spellerizing features. A good workmanlike installation deserves to be backed by pipe that will measure up to every expectation of both the installer and the owner. The NATIONAL Scale Free process (applied to butt-weld sizes ½ to 3-inch) and the Spellerizing process (size 4-inch and under) give a real protection against corrosion, while the uniform, strong, ductile steel and good threading qualities of NATIONAL make for easier and quicker time on the job. Consistent use in the plumbing and heating field by discriminating buyers for many years has made NATIONAL Scale Free Pipe—*America's Standard Wrought Pipe.*

NATIONAL TUBE COMPANY • Pittsburgh, Pa.
Pacific Coast Distributors—COLUMBIA STEEL CO., San Francisco, Calif.
Export Distributors—UNITED STATES STEEL PRODUCTS CO., New York, N. Y.

United States Steel Corporation Subsidiary



CHROMATE TREATMENT—*All National Galvanized Pipe is given a special chromate treatment to resist discoloration and the formation of white rust. This patented process preserves that smooth, glistening surface or metallic lustre which is characteristic of good galvanizing.*



Shallcross Draft Control

Shallcross Controls, Inc., 3707 North Richards St., Milwaukee, Wis., has developed the type L-125-A draft control which consists of a draft switch, damper motor, and manual station. The control maintains a constant draft within the boiler or furnace by adjusting the stack damper. The draft switch, which is mounted on the front of the boiler with a connection to the furnace, is of the diaphragm type with removable cover. It is adjustable up to 0.3 in. draft and is said to be sensitive to less than 0.10 in. change in draft. The damper motor which operates the stack damper consists of a shaded pole, reversible induction motor with a steel gear train, all submerged in oil. Optional type motors are of the shunt wound d.c. or capacitor a.c. type. The manual station, also mounted on the front of the boiler, provides the means for manually operating the damper.

Three switches provide the means for manually operating the damper —two pushbutton switches marked "Open" and "Close" and a selector switch marked "Auto," "Off," and "Hand."

The damper moves only as long as the pushbutton is held depressed and stops when released, remaining in that position until again operated from one of the pushbuttons or until the switch is thrown to "Auto," when automatic control is resumed.

Travel limits in the damper motor prevent motion of the damper beyond the open or closed positions, on both automatic and hand operation.

G. E. Self-Contained Conditioner

A self-contained room cooling unit which uses no special power lines or water supply and drain piping has been announced by the air conditioning department of General Electric Co., Bloomfield, N. J.

The unit, listed as type FC-2, may be installed by adjusting its duct connection to the nearest electrical outlet. Its four motors start in staggered sequence so that there is no heavy inrush of starting current. The unit is air-cooled and no water connections are necessary. Drain connections are eliminated as the water condensed on the cooling coils is evaporated into the condenser cooling air and blown outside.

The upper part of the cabinet houses fans, filters, control switches and window duct connection. One motor drives the two sets of fans. One set recirculates air from the room, brings in outdoor air, sends the mixed air through filters, over the evaporator coils to cool and de-humidify it, and then out into the room. The second set of fans brings in outdoor air, filters it, passes it over the condenser coils and over the drip pan which collects condensate from the evaporators, and sends this heated, moisture-laden air outdoors. In filtering the condenser cooling air before it flows over the coils, maintenance requirements are said to be reduced, for otherwise, according to the maker, the fins on the condenser coils would clog with dirt, the motors would be overloaded and the cooling capacity reduced.

The unit is manually controlled, all controls being interlocked to prevent incorrect operation. It circulates 275 c.f.m. Its refrigeration capacity is slightly less than the equivalent of the use of a half ton of ice in 24 hours.

Heatanaire

May Oil Burner Corp., Baltimore, Md., has introduced the Quiet May Heatanaire conditioner. The purpose is to heat, humidify, filter and circulate conditioned air in dwellings. In addition, it provides year 'round hot water.

The equipment includes a tankless domestic hot water heater, oil burner, steam boiler, indirect heat exchanger, and direct heat exchanger. Air is recirculated from the conditioned space to the return ducts and passes through filters from the blower and over the heat exchanger where it is warmed. It then passes through the direct air heater and over the humidifier and is further warmed and moistened. It is then supplied to the room to be conditioned.

Lammert Control Valves

Lammert & Mann Co., 280 N. Wood St., Chicago, has announced a line of liquid control or automatic shut-off valves. Features are said to include: few parts; compact design; large capacity; interchangeable elements for air control, steam pressure control, water pressure control or electrical control. Any one of these controls is connected by screwing it into the standard valve-body mechanism.

The valve itself has two moving parts and is held in position, when closed, by a cadmium-plated spring. The valve needle and seat are of stainless steel. Any part of the valve can be removed without detaching the valve from the line.

The operating lever, which is actuated by the control device, transmits the force to lift the needle valve. The interlock and manual reset device is a latch-and-weight arrangement which holds the valve in position after it has closed, until the weight has been reset manually.

The air control mechanism is of the piston type, and a pressure of 3 to 50 lb. may be used. The air operated valve is used on oil burners of the air atomizing type. It prevents oil dripping into the combustion chamber when the burner is off, and closes the valve automatically in the absence of the atomizing agent.

They are made in standard sizes from $\frac{3}{8}$ in.

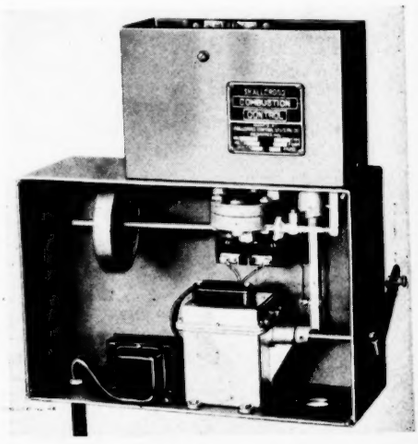
Shallcross Combustion Control

Shallcross Controls, Inc., 3707 North Richards St., Milwaukee, Wis., has introduced the type MC combustion control for steam boilers. Its purpose is to maintain a uniform steam pressure and a correct flow of air for all rates of fuel supply. It can be used with any kind of fuel and is adaptable to any size boiler with pressures from 25 to 400 lb.

A steam pressure element, sensitive to pressure changes of less than one per cent of normal, actuates a motor driving a crank (or sheave) connected to the speed control member of the stoker or to the fuel valve of the gas or oil burners.

As the load varies, the fuel is readjusted to meet the new load conditions, maintaining the necessary steam pressure. The control is of the full floating type, and makes slight readjustments in the fuel on small load changes, larger adjustments on larger changes.

While the fuel feed is being adjusted to maintain the steam pressure the air supply is also maintained in ratio to the fuel. Two adjustments are provided: steam pressure desired and ratio of air to fuel.



Silent Servants

AUTOMATIC BUTLER COAL STOKERS
EMERSON QUIET-BUILT MOTORS

QUIET

With nearly 45 years' experience in building the finest grade motors to its credit, Emerson is unusually well equipped to produce Quiet Motors. A soundproof, vibration-proof testing laboratory and specially designed scientific equipment, with which to analyze the complex wave form, are in constant use to insure uniform production of Quiet Motors—yet Emerson Motors are competitively priced.

Creative Engineering of highest order marked each step in the development of the Automatic Butler Coal Stoker. This is evidenced in its compactness, the flexibility of its heating service, and its streamlined styling. Also in its silent operation—due to the use of anti-friction bearings, precision-machined gears, a statically and dynamically balanced fan rotor, cushion mounting and rubber insulation.

These exacting standards so closely parallel those in constant use at Emerson, that it was only natural that Emerson engineers should be entrusted with the task of designing the Automatic Butler's Motor. Result: a capacitor type motor with low starting current, free of radio interference noises, resilient rubber mounting—an equally silent servant.

One of the world's pioneers in motor-building, Emerson asks only an investigation of what it has to offer. Begin the investigation today by writing for Bulletin 19V.

EMERSON MOTORS

3 HP and smaller—Single-phase—Polyphase—Direct Current

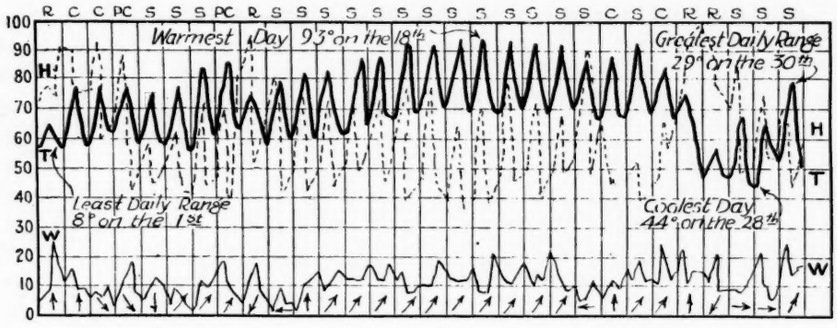
THE EMERSON ELECTRIC MFG. CO.

NEW YORK ST. LOUIS CHICAGO

LEADERS IN THE FAN AND MOTOR INDUSTRY SINCE 1890

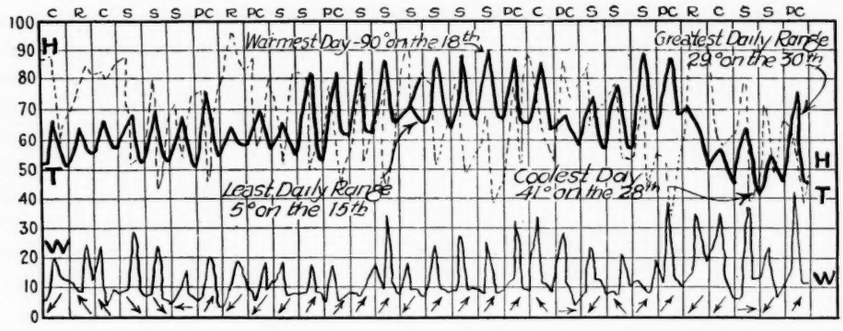
THE WEATHER FOR SEPTEMBER, 1935

Plotted from records compiled for HEATING AND VENTILATING by the U. S. Weather Bureau. Heavy curves (T), dry bulb temperatures in deg. F.; dotted lines (H), per cent relative humidity, from readings at 8 a.m., noon, and 8 p.m., except for New York, which shows hourly readings. Light lines (W), wind velocity in m.p.h. Arrows indicate prevailing wind directions. S—clear; PC—partly cloudy; C—cloudy; R—rain; Sn—snow.



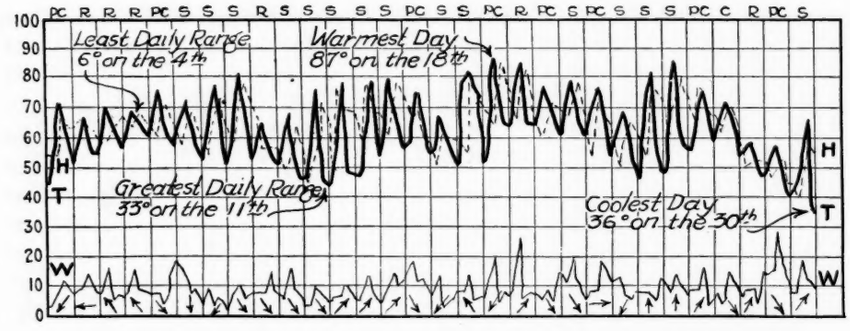
St. Louis

Mean temp. for month, 71.4°; aver. wind velocity, 10.3 m.p.h.; prevailing direction of wind, SW.



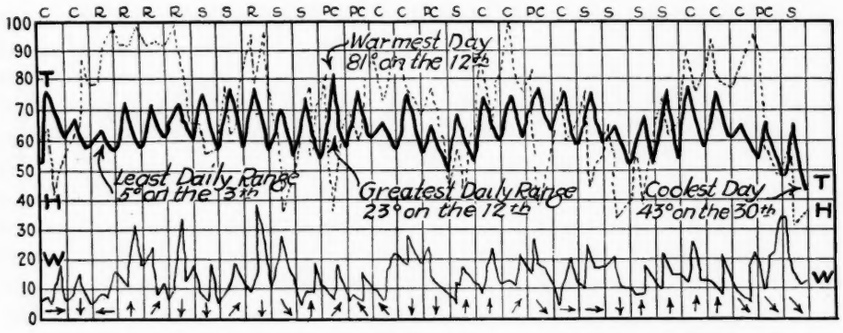
Chicago

Mean temp. for month, 65.8°; aver. wind velocity, 9.9 m.p.h.; prevailing direction of wind, SW.



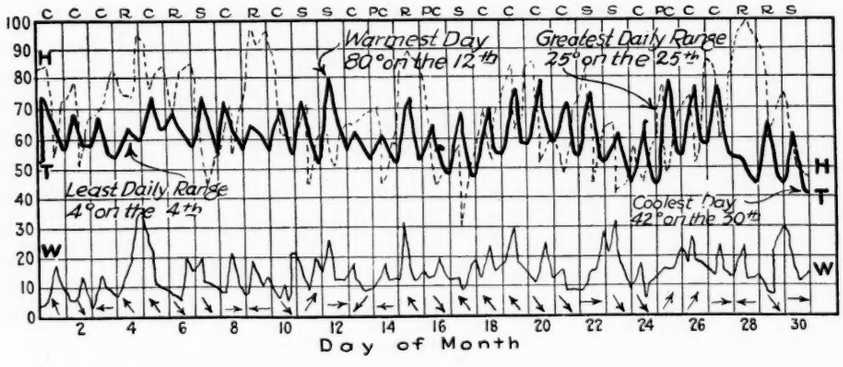
Pittsburgh

Mean temp. for month, 63.4°; aver. wind velocity, 8.1 m.p.h.; prevailing direction of wind, SW.



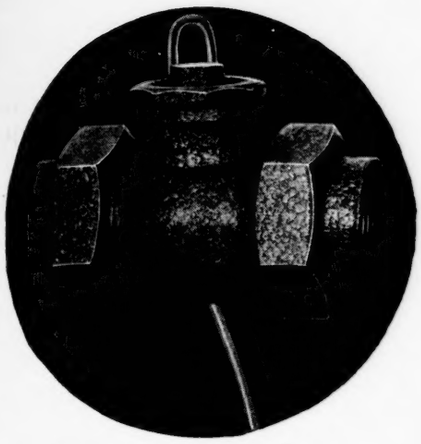
New York

Mean temp. for month, 64.2°; aver. wind velocity, 12.6 m.p.h.; prevailing direction of wind, SW.


Warmest Day 80° on the 12th
Greatest Daily Range 25° on the 25th
Least Daily Range 4° on the 4th
Coolest Day 42° on the 30th
Day of Month

Boston

Mean temp. for month, 61.4°; aver. wind velocity, 13.1 m.p.h.; prevailing direction of wind, W.



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BANISHES THE "CHILLS AND FEVER" FROM INDUSTRIAL PLANT HEATING

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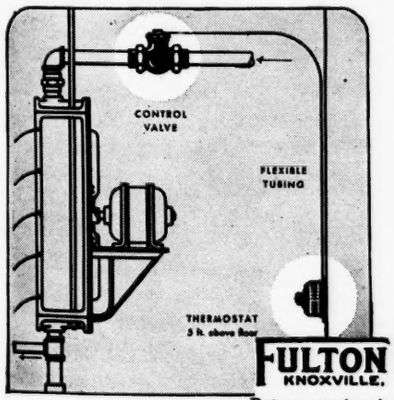
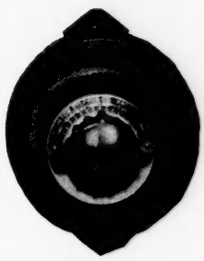
Once you could do nothing about it if the area was unit-heated. The fans were either off or on and as much steam was wasted in overheating as was usefully employed.

Now—the Sylphon No. 7 Unit Heater Control offers you the *Modulating* control you have always wanted, accurately meters the amount of steam admitted to one or a group of unit heaters to maintain uniform temperature at the breathing line.

Outstanding advantages are: Entirely mechanical operation. Self-contained and self-sufficient. Easily installed. Adaptability to a wide range of unit heater control problems, used either alone or in conjunction with automatic fan switch. Remarkable evenness of control, due to modulating action. Real fuel savings.

Write for Bulletin VH-542, sent on request.





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KNOXVILLE, TENN., U.S.A.

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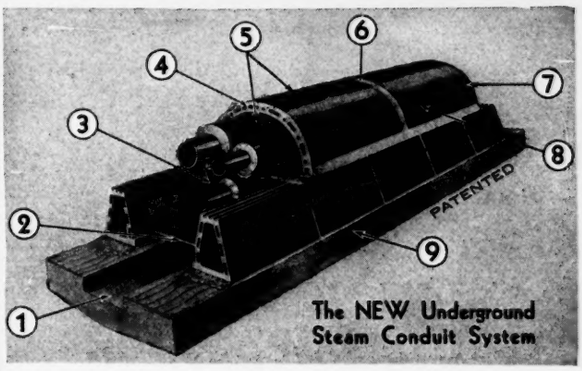
TEN THERM-O-TILE FEATURES

Reg. U. S. Pat. Off.



1. Drainage entirely internal. No external drain required. Permanently dry insulation space assured.
2. Asbestos separator plate—supports fibre insulation when used.
3. Cast iron adjustable pipe supports for all pipe sizes and combinations. 12 ft. centers. Rest on concrete base.
4. Sealed air channels. Increase efficiency of insulating medium used.
5. Piping and conduit independently supported.
6. Waterproof mortar interlocks in channels and seals joints. Smooth exterior. Permits membrane waterproofing where desired.
7. Arched construction. Tests prove great strength.
8. Conduit may be opened without renewing parts.
9. Monolithic foundation poured on trench bottom. Convenient "sidewalk" for pipe contractor.
10. Thermal efficiency guaranteed, under test.

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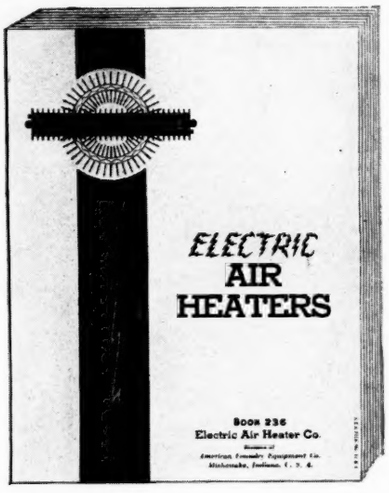

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Obtainable in sheets, strips, and formed to specifications.

W. M. CHACE VALVE CO.
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The Degree-Day Explained

(Continued from page 53)

70° with minimum outside temperature of 0°. If the system was designed for temperatures other than 0° — 70°, multiply by the factor:

$$\frac{70°}{70° - \text{outside temperature designed for}}$$

For example, if this system was designed to maintain 70° in + 10° weather, the factor would be

$$\frac{70}{70-10} = \frac{7}{6}$$

This correction often causes confusion inasmuch as it apparently seems that for southern cities with relatively high minimum temperatures this fraction is more than 1, giving the impression that more fuel is used in a southern city than in a northern one. Note, however, that this is a *unit* figure; that is, the fuel consumption per square foot of radiator per degree-day. A southern building where a minimum outside temperature would be 30° would have only $\frac{70-30}{70}$ or 4/7 of the amount of radiator surface installed in a given building as would be required in exactly the same building in a northern city where the minimum temperature is 0°. Consequently, for the total building this fraction and the one relating to the minimum design temperature would cancel each other and the amount of fuel used in the whole building in each location would be the same *per degree-day*. The southern city having fewer degree-days in a season obviously, then, would use less fuel for the season.

An additional correction must be made for the efficiency of the system. The factors as given are based on 100% fuel burning efficiency which is obviously never obtained. Corrections can be made for this according to the judgment of the user as to the efficiencies of different types of systems and fuels. To correct, divide the unit figure by the efficiency.

The question is sometimes raised as to whether the amount of radiator surface used in the building in connection with the degree-day should be the net installed surface or the total amount, including piping. The answer is that the quantity used should be the amount determined by the heat loss calculations. In an existing job it is difficult to say whether the designer has allowed too much or too little radiator surface so that the quantity used in connection with the degree-day should be the theoretical figure arrived at by calculation rather than the net installed or gross surface.

Example of Use of Degree-Day

What will be the coal consumption in the city of Philadelphia for a stoker operated heating plant containing 400 sq. ft. of hot water radiation, designed to maintain 70° in weather 10° above zero, the coal having a heating value of 10,000 B.t.u. per lb. and an efficiency of the system being assumed at 55%?

We have noted that 0.008 lb. of coal is required under certain conditions. In our example, a water system is installed instead of steam, so that we multiply our 0.008 by 5/8 to obtain 0.005. Our system was designed for + 10°, so that we multiply our 0.005 by 7/6 to

obtain 0.00584. Assume a 55% operating efficiency, divide 0.00584 by 0.55, and we get 0.0106.

The heat value of the fuel in our example being 10,000 B.t.u. per lb. instead of 12,000, we multiply the 0.0106 by 12,000/10,000 to obtain 0.0127, which is the pounds of coal required per degree-day per square foot of radiator. Since our example gives 400 sq. ft. of radiator, we multiply 0.0127 by 400 and obtain 5.08 lb. of coal for this system per degree-day. Since Philadelphia has 4,855 degree-days per normal season, the fuel consumption for a year will be 4,855 multiplied by 5.08, or 24,633 lb., or 12.3 tons. The table below shows the progressive steps used in solving:

Type of System	Design Temperature °F.	Efficiency, %	Heating Value B.t.u. per Lb.	Lb. Coal per Sq. Ft. Radiator per Degree-Day
Steam ...	0-70	100	12,000	0.008
Water ...	0-70	100	12,000	0.005
Water ...	10-70	100	12,000	0.00584
Water ...	10-70	55	12,000	0.0106
Water ...	10-70	55	10,000	0.0127

Comparing the Heat Consumptions of Buildings

(Concluded from page 37)

heating season will approximate the true annual consumption.

The savings effected by a control system can be shown graphically by drawing the Maximum Heat Load Curve and the Heat Load Curve with Control as illustrated, plotting the curves by values obtained over an extended period of operation or by test runs made with and without control as hereinbefore outlined. The area lying between the two curves represents the savings.

What few tables of heat consumption comparisons of buildings are available today are of little or no value because of the fact that no attempt has been made to compensate for the variable conditions. In no table of heat consumption comparison found was there sufficient information included from which a fair and true comparison could be made. Until such time as a standard basis of comparison is adopted and until such time as building occupancy, hours of heating, maintained temperature, radiation basis and climatic conditions are taken into consideration in building comparisons, there can be no true evaluation of comparable building heating. With modern conditions demanding automatic control of building heating, it is necessary that some fair standard basis of comparison be established so that building operators may determine the most efficient and economical method of operating the heating plant.

Heating Index Up in August

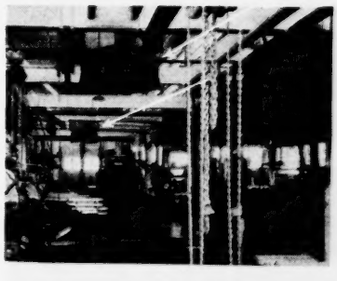
(Continued from page 55)

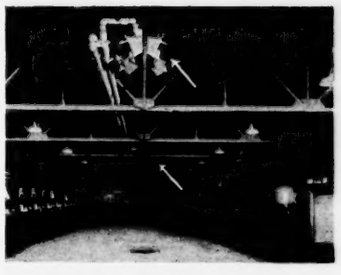
last year. Sales of the former amounted to 423,581 sq. ft. in August as against 151,303 last year. Domestic stoker installations in August, 1934, were 1,976, up to 4,928 this year.

Other increases were: non-ferrous convectors, up 30%; cast iron indirect heating surface, up over 125%; and non-ferrous heating surface, up about 15%.

Reports from large utility companies indicate that air conditioning installations connected to their lines during the first eight months total the same as last year.

(Concluded on page 74)





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It is the scientific method of heating any size area economically and satisfactorily. The vertical downward discharge of the comfortably heated air is one of the exclusive features of the

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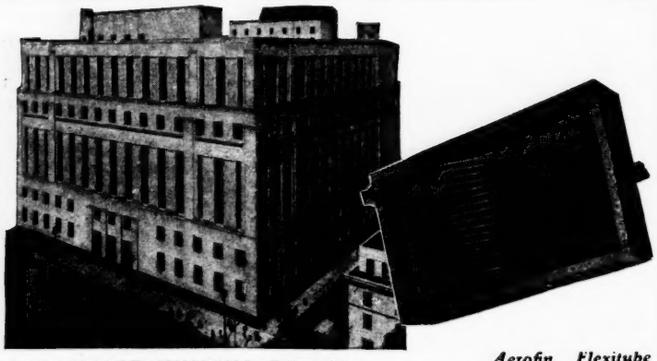
Aerofin is years in advance of ordinary heating and cooling surface because of its exclusive features. It is available in aluminum, copper or other special metals. Whatever you have wished for in a fan system surface you will find in Aerofin.

The home office in Newark or any of our branch offices will gladly send complete descriptive literature or render prompt, personal and efficient technical cooperation. Simply write to the address below.



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Aerofin Was the Choice When It Came to Fan System Surface for the U. S. Post Office in Detroit.

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Aerofin Flexitube Unit for Heating or Cooling with water.

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850 FR ENUE
CHICAGO DETR PHILADELPHIA

(Concluded from page 73)

However, the usual seasonal decline is now apparent in the reports, and not a great deal of business can be expected the remainder of the year.

On October 21 the Federal Housing Administration announced that FHA-insured loans had passed the $400 million mark. Of this $185 million was for modernizing, $200 million for Title II mortgages, and the remainder for low-cost housing mortgages.

A 54% increase in building in 1936 over 1935 was predicted by Russell G. Creviston, advertising and sales promotion manager, Crane Company, at a recent meeting of the Central Supply Association in Chicago. Mr. Creviston foresees a 100% increase in residential construction, a 20% gain in commercial building, a 20% gain in industrial building, and a 10% rise in institutional building.

NEW CATALOGS

Unless otherwise indicated, the publishers of catalogs will supply copies on request without charge.

Aerovent Fan Co., Piqua, Ohio. A new line of exhaust fans is described in a bulletin devoted to the Aerovent Macheta Airfoil fans, available in a variety of ratings. Includes a story of the development, and the exposition of the results attainable through taking advantage of fundamental aerodynamic principles.

Bethlehem Steel Co., Inc., Bethlehem, Pa. Illustrated folders, 333 and 334, describing corrosion-resisting qualities of Beth-Cu-Loy sheets as determined by tests carried on in a concentrated industrial area at Brunot Island, Pittsburgh; in salt air at Key West, Fla., and at other points, under more normal atmospheric conditions.

The Brown Instrument Co., Philadelphia, Pa. Catalog 8900 entitled "Brown Air Operated Controllers." Illustrates the construction and method of adjustment obtainable in this device. Performance of the throttling range, the automatic reset dials and interchangeability of the control units are explained. Standard size, 24 pages profusely illustrated.

Crane Co., 836 S. Michigan Ave., Chicago. A "Boilers and Radiators" catalog illustrated in color and describing eight different styles of boilers, round and sectional, plain and jacketed, for hot water and steam heating systems, to burn coal, coke, oil, or gas, in sizes to fit the requirements of residential and commercial buildings. Includes engineering tables, technical data, charts, blueprint drawings, sectional illustrations, performance data records. Also includes data on the company's radiators—legless, bathroom, wall, hospital, humidifying, convectors, etc. Directed radiation by means of radiator invisible shields also is graphically described, as well as speed heaters, radiator valves, hangers, traps, vents, gauges, regulators and all necessary heating accessories. Standard size, 56 pages.

Electric Air Heater Co., Division of American Foundry Equipment Co., 617 Byrkit St., Mishawaka, Ind. A 24-page data book, No. 236, illustrating and describing space heating by Electromode forced heat, giving cost comparisons with other methods of heating, and illustrating applications of industrial, portable, and Bilt-in-Wall all-electric fan type unit heaters. Detailed information on heating costs, with all types of heating methods compared.

Julien P. Friez & Sons, Inc., Baltimore St. and Central Ave., Baltimore, Md. Bulletin F, a single-page, standard size, punched sheet describing and illustrating the company's air meter intended for the study and measurement of pressures or vacuums as well as velocities of air inside of ducts or at the face of grilles, fans, and other outlets. The meter covers velocities as low as 140 f.p.m. and up to 2,832 f.p.m., and pressure or vacuums as low as 0.00125 in. and up to 0.50 in. of water.

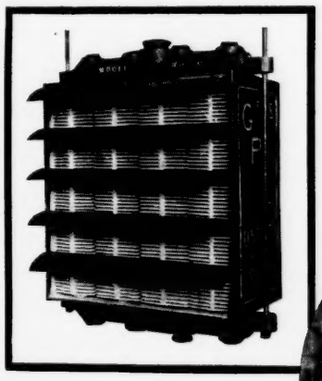
General Refractories Co., 106 South 16 St., Philadelphia. Bulletin entitled "A New Application of the Ritex Process to the Manufacture of Chrome Brick," by R. P. Heuer, director of research of the company.

Janette Manufacturing Co., 556-558 West Monroe St., Chicago. Bulletin 225, containing very brief descriptions and illustrations of the company's products which include hydrolators (motorized hot water circulating pumps), d.c. and a.c. motors, oil transfer pumps, blower wheels, small housed blowers, motor generators, motorized speed reducers, and rotary converters.

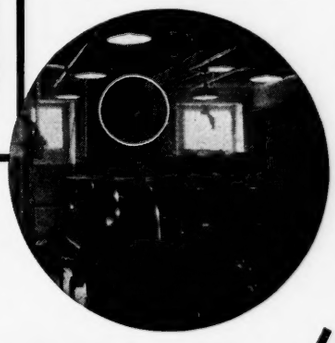
Modine Manufacturing Co., Racine, Wis. Catalog 635, covering unit heaters. Includes all current models plus four new models which have recently been developed.

Contains a detailed description of the company's unit heater features, including the direct-from-steam-pipe suspension, expansion bend, velocity generator and all-copper condenser. Industrial applications of unit heaters for process work as well as for heating purposes are discussed. Complete dimensional diagrams and data tables accompany each description of the units. Two pages are devoted to methods of determining heat requirements, heat loss calculations, and the capacities and final air temperatures of all units at various steam pressures and entering-air temperatures.

Servel, Inc., Commercial Refrigeration Div., Evansville, Ind. A 16-page, 4 in. x 9 in. folder entitled Servel Commercial Refrigeration and Air Conditioning. Gives brief descriptions, illustrations, and some capacity data on heavy duty compressor-condenser units with capacities from ½ to 1 ton; summer and year 'round unit conditioners of both floor and suspended type; air cooled compressor units with capacities ranging from 130 to 3,000 lb. ice making equivalent capacity per day; water cooled compressors ranging in capacity from 500 to 14,000 lb. ice making equivalent capacity per day; beer and beverage coolers; Humidraft units for chilling food stuffs; ice cream cabinets, and cross finned heating coils.



GRID
UNIT HEATER

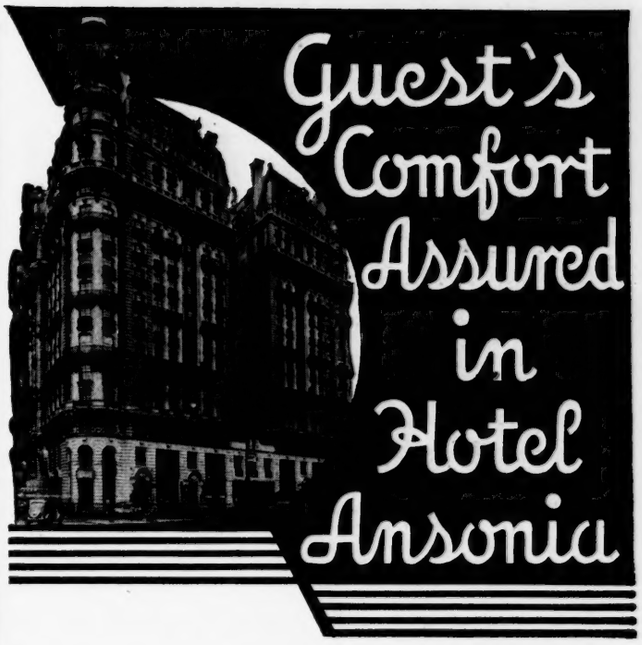


Will operate efficiently in a plant where lint, fumes, dust or particles in the air may have previously caused trouble. It's the one unit heater that can easily be kept clean. Delivers warm air to floor and lower portion of room—always.

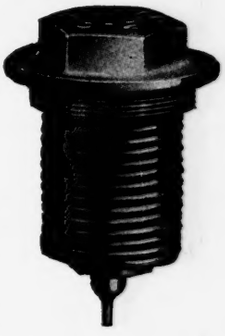
NO OTHER UNIT HEATER LIKE IT!

The Grid has features that are distinctive among unit heaters—important of which is the all-cast aluminum and iron radiation. The heating sections are made of special aluminum alloy cast metal to metal bond with the steam chambers. Grid will never fail due to electrolytic corrosion. The Grid is built to last without maintenance cost. Learn the complete details now.

The UNIT HEATER & COOLER Co.
WAUSAU ~ WISCONSIN



In the Ansonia Hotel, New York, an old steam heating system was made equal to new by equipping all radiator traps and inlet valves with Sarco Adapters.



These consist of replacement units which can be screwed into old trap and valve bodies of any make without disturbing piping connections.

Sarco Adapters

eliminate hammering noises at once. Radiators heat up more quickly, and ample steam can be fed to all parts of the system at greatly reduced steam pressures.

The result is not only guest or tenant satisfaction, but a saving in fuel dollars which quickly pays for the work of modernization.

Let us tell you more about this simple method of turning losses into profit. Write for catalog P-111.

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is like the reliability
of handmade skates
from the world's
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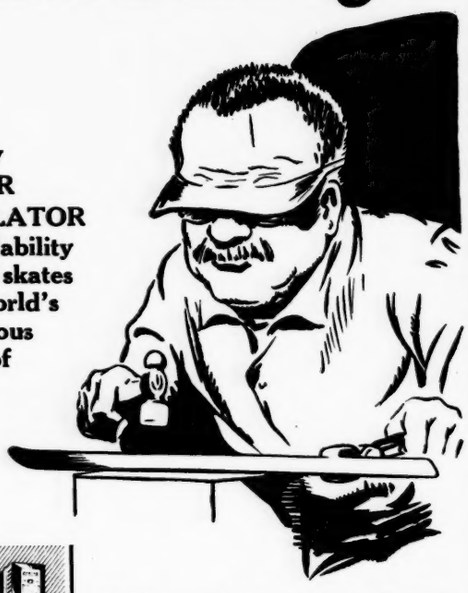

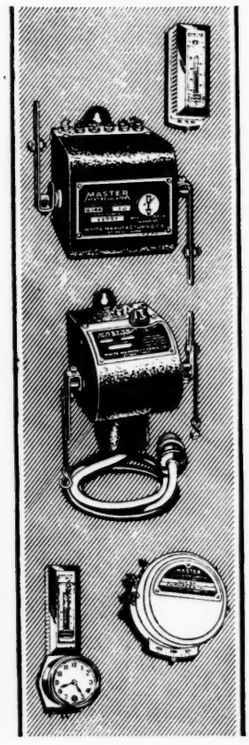

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4 Position

The regulator de luxe responds instantly to temperature changes of a fraction of a degree. Equipped with the famous Master Thermo-Wafer, platinum iridium contacts and 4 watt non-inductive starting switch—a marvel of advanced engineering.

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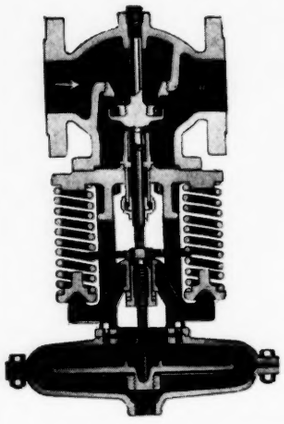
PRESSURE REGULATORS *for* HEATING SYSTEMS



Of the many Foster Pressure Regulators in use the Type 35A1 (illustrated) is probably the most widely used in connection with heating systems in hotels, institutions, apartments, office and other buildings. It is recommended for fairly constant initial pressures up to 250 pounds and for delivery pressures between 3 and 150 pounds. Single-seated and suitable for dead-end service.

Type 35A2, double-seated, is recommended where initial pressures are variable but not for dead-end service. Note the accessible springs and ease of adjustment. Sizes of the A1 Valves range from ½" to 6"; A2 Valves up to 10".

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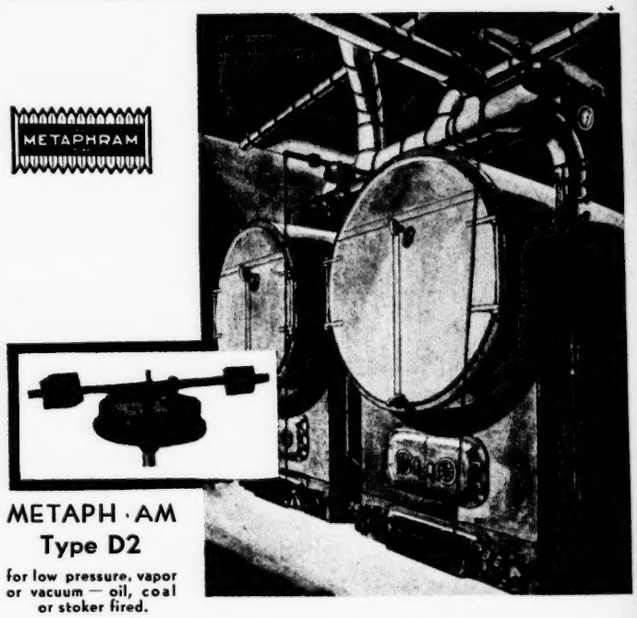

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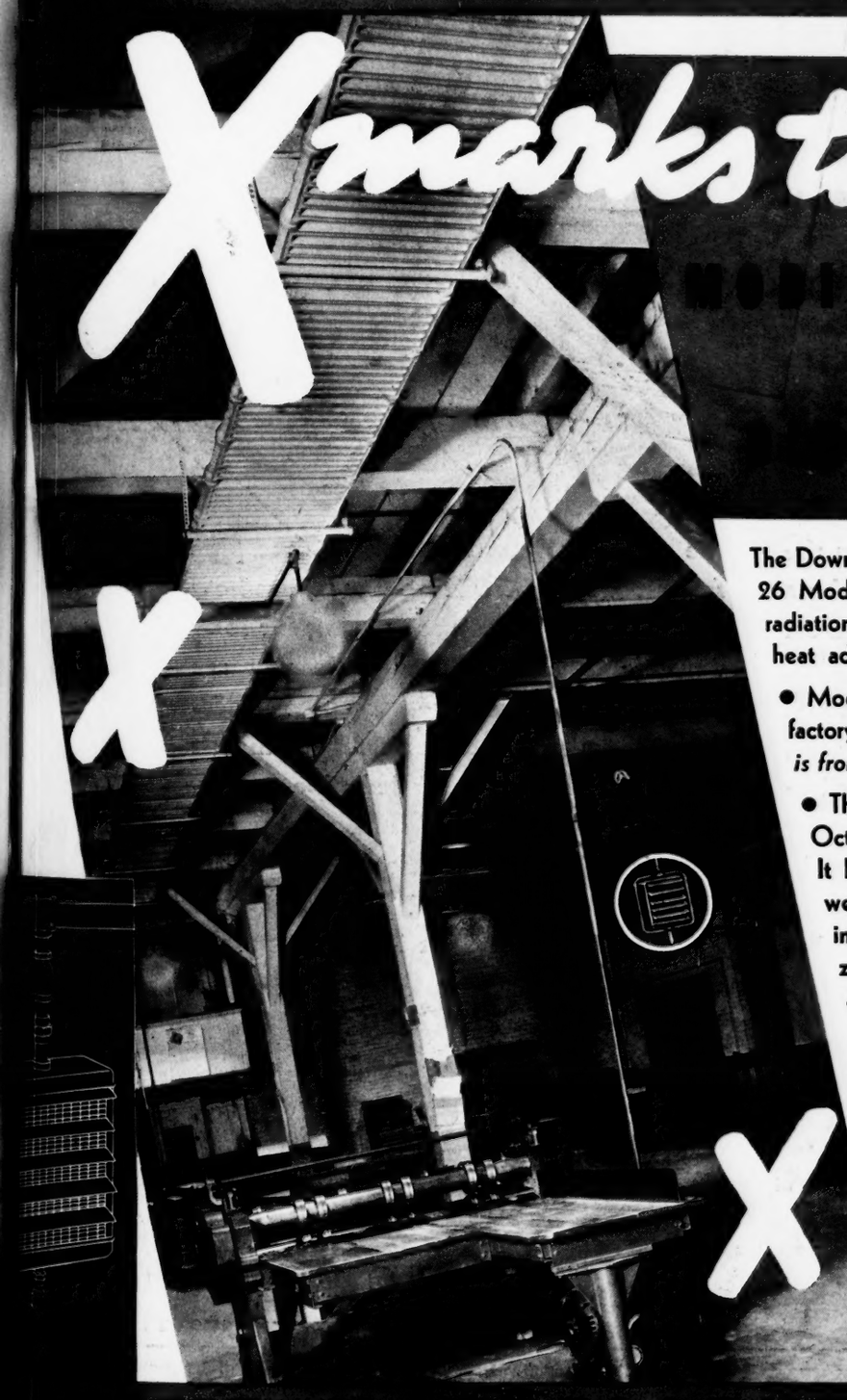

The Downing Box Co., Milwaukee, Wis., has installed 26 Modine Unit Heaters to replace 35 tons of direct radiation. While the Modines weigh but 1⅔ tons they heat additional spaces which the old system did not.

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- Overhead and out of the way, Modines waste no valuable space. They deliver the heat *downward* to the floors and working zones where it is needed. Heat is *evenly* distributed, and temperature *thermostatically controlled.* A unit need be operated only when the area it serves requires heat. No fuel is ever wasted.
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